FMFM 8-1

SPECIAL OPERATIONS

U.S. MARINE CORPS

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DEPARTMENT OF THE NAVY
HEADQUARTERS UNITED STATES MARINE CORPS
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13 August 1974

FOREWORD

1. PURPOSE

This publication, FMFM 8-1, Special Operations, sets forth doctrine, procedures, and techniques for the employment of Fleet Marine Force units in special operations. The DOD Dictionary of Military and Associated Terms (JCS Pub. 1) defines special operations as "secondary or supporting operations which may be adjuncts to various other operations and for which no one Service is assigned primary responsibility."

2. SCOPE

This manual outlines the operational requirements of amphibious raids, withdrawals, demonstrations, and river crossings. It also discusses the climatic and environmental influences of cold weather, mountains, deserts, and jungles.

3. SUPERSESSION

FMFM 8-1, Special Operations, dated 13 May 1968.

4. CHANGES

Recommendations for improvement of this manual are invited. Comments and recommended changes should be forwarded to the Commanding General, Marine Corps Development and Education Command (Director, Development Center), Quantico, Virginia 22134.

5. CERTIFICATION

Reviewed and approved this date.

BY DIRECTION OF THE COMMANDANT OF THE MARINE CORPS

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USER SUGGESTION FORM

From:

To: Commanding General, Marine Corps Development and Education Command (Director, Development Center), Quantico, Virginia 22134

Subj: FMFM 8-1, Special Operations; recommendation(s) concerning

1. In accordance with the Foreword to FMFM 8-1, which invites individuals to submit suggestions concerning this FMFM directly to the above addressee, the following unclassified recommendation(s) is(are) forwarded:

a. ITEM #1 (May be handwritten; if more space is required, use additional sheets and envelope.)

(1) Portion of Manual: (Cite by paragraph and/or page number.)

(2) Comment: (Explain in sufficient detail to identify the points of the suggestion.)

(3) Recommendation: (State the exact wording desired to be inserted into the manual.)

b. ITEM #2

(1)

(2)

(3)

c. ITEM #3 (etc.)

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RECORD OF CHANGES

Change No.	Date of Change	Date of Entry	Organization	Signature

SPECIAL OPERATIONS

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CHAPTER 1

AMPHIBIOUS RAIDS, DEMONSTRATIONS, AND WITHDRAWALS

Section I. AMPHIBIOUS RAIDS

1101. GENERAL

An amphibious raid is a landing from the sea on a hostile shore. It involves swift incursion into or temporary occupancy of an objective and a planned withdrawal. It is planned and executed in accordance with standing amphibious procedures delineated in LFM 01, Doctrine for Amphibious Operations; LFM 02, Doctrine for Landing Forces; and FMFM 3-1, Command and Staff Action. The raiding force may employ surface and/or subsurface means of transportation, helicopters, transport aircraft, or parachutes as methods of entry and/or exit in the objective area.. In some cases, a combination of these means may best serve the mission of the raid. Once the raiding force is ashore, the concept of operation normally provides for rapid and aggressive execution of the assigned raid task followed by the immediate withdrawal of the raiding force.

1102. COMPARISON WITH AMPHIBIOUS ASSAULT

The raid differs from the amphibious assault basically in that it is of short duration and includes a planned withdrawal from the objective. Plans for a raid may also embody any or all of the following variations:

a. In small-scale raids, beaches or helicopter landing sites are selected to provide the greatest chance of achieving tactical surprise.

b. The limited duration of a raid and the surprise which can be achieved may obviate the necessity for gaining air and naval superiority within the objective area.

c. Deployment of the raiding force may not be required until the assault of the objective.

d. In conjunction with a main attack, raids can be conducted to strike at the enemy's seacoast positions, flanks, or rear areas.

e. Logistic support requirements are limited.

f. Communication requirements may be simplified through detailed planning and rehearsals.

1103. CLASSIFICATION AND PURPOSE OF AMPHIBIOUS RAIDS

Amphibious raids may be supported to such a degree that they resemble the early stages of an amphibious assault, or they may be accomplished largely by stealth. At the same time, a raid may be an independent operation, an operation in support of another landing and/or land campaign, or in support of an air or naval operation. Regardless of the degree of support provided or the general purpose of an amphibious raid, its specific aims normally provide for any or several of the following:

a. Psychological.--A raid may be conducted solely for psychological reasons; e.g., to lift the morale of friendly military personnel and/or civilians. Such a raid may be particularly necessary at the outset of hostilities or later if friendly forces have been in a defensive posture for a long time. Raids conducted under such circumstances may pay dividends by keeping the operating forces "offensive minded."

b. Destruction.--Raids may be employed to destroy certain targets, particularly those that are not susceptible to destruction by other means. Targets for destruction may include military or industrial installations, communication facilities, and transportation facilities such as bridges and tunnels. Raids aimed at destruction may have either strategic or tactical significance or both.

c. Harassment.--Raids can harass the enemy when they are directed against isolated posts, patrols, and headquarters to capture or kill key personnel. In addition to such specific aims, harassment of the enemy may lower the enemy's morale.

d. Reconnaissance.--Amphibious raids can gather information on hydrography, terrain, and the enemy to include his dispositions, morale, strength, movement, and weapons.

e. Diversion.--The raid may create a diversion in connection with strategic or tactical deception.

f. Evacuation.--The amphibious raid may be used to evacuate individuals, including agents, or material.

g. Unconventional Warfare.--A series of amphibious raids can be employed to establish, support, or coordinate unconventional warfare activities.

1104. MORALE EFFECT

The morale effect of raids may be far more important than their immediate operational results. A series of successful raids may significantly

affect both friendly and enemy morale. In planning an amphibious raid, the operational importance of the raid target should be considered in light of possible morale effects. The adverse morale effect of one fiasco outweighs that of several successful raids. Therefore, the target is always one that is not guarded by a formidable hostile force.

1105. RAIDS AS SEPARATE OPERATIONS

a. General.--Amphibious raids, conducted as separate operations, may be designed to:

(1) Destroy critical targets.

(2) Capture vital enemy equipment or personnel.

(3) Gain information.

(4) Harass the enemy.

(5) Boost the morale of local civilians and guerrilla forces.

b. Raids to Destroy Critical Targets.--Amphibious raids may be conducted to destroy critical targets that cannot be reduced by air, naval gunfire, or other weapons. In 1942, a 13-man Norwegian raiding force, trained by the British, successfully destroyed the Vermok plant in Norway. This raid deprived the Germans of the capability to produce heavy water, and possibly prevented them from developing the atomic bomb.

c. Raids to Capture Equipment or Personnel.--In May of 1944, a small party of British raiders and local guerrillas (total party of nine men) captured the German commander of Crete, General Kriepe.

d. Raids to Gain Information.--The amphibious raid may be employed in situations where existing intelligence gathering means are inadequate or unreliable. In May of 1945, British raiders were landed by submarine in Malaya to determine the suitability of the beaches for amphibious assault.

e. Raids to Harass the Enemy.--Amphibious raids may be employed to harass isolated enemy forces and/or installations and cause him to divert combat troops for security duty. Numerous raids were conducted by British and Americans in all theaters of World War II for this purpose. During the Korean War, several raids were made on the east coast of Korea. Reports indicate that 7,000 North Korean troops were "frozen" and over 400 miles of triple entrenchments and gun positions had been constructed as protection against these forays. Raid targets generally consisted of coastal railways, bridges, tunnels, and communication systems.

f. Raids for Morale Purposes.--An amphibious raid may gain a bonus effect as a morale booster. Raiding campaigns are highly effective in encouraging guerrilla and partisan activity in an enemy occupied country. However, this activity may hurt guerrillas and partisans by creating/intensifying counteraction. In addition to assisting the efforts of such groups, active raiding tends to divert suspicion from underground units.

1106. RAIDS IN SUPPORT OF OTHER OPERATIONS

a. General.--Raids in support of other operations normally fall into one of the following categories:

(1) Support of a landing by a larger force.

(2) Support of naval operations.

(3) Support of air operations.

(4) Support of a land campaign.

b. Support of a Landing by a Larger Force.--The amphibious raid executed to support the landing of a larger force may be designed to:

(1) Strike at key facilities that will disrupt or delay enemy reaction to the landing by the larger force. Raid objectives may be enemy command posts, communication centers, or transportation systems.

(2) Destroy selected enemy defenses or critical targets that cannot be reduced by air attack or naval gunfire.

(3) Create a diversion in a different area so as to draw the enemy's combat forces away from the locale of the target landing.

c. Support of Naval Operations.--Raids may be employed to support naval operations by destroying or neutralizing targets such as coast artillery, guided missiles, electronic installations, submarine pens, refueling stations, drydocks, harbor defenses, and similar installations that affect friendly naval operations.

d. Support of Air Operations.--Raids in support of air operations may be designed to:

(1) Destroy targets invulnerable to air attack.

(2) Attack key air facilities, industry, antiaircraft positions, or control systems.

(3) Locate targets and direct airstrikes from within enemy territory.

(4) Seize airfields or landing zones for temporary use by friendly aircraft.

e. Support of Land Campaign.--Amphibious raids may support land campaigns by striking enemy rear installations or flanks that rest on or near seacoasts. Raids may cause the enemy to divert sizeable forces to protect his seacoast, supply lines, and rear areas.

1107. FACTORS AFFECTING THE RAIDING FORCE

The military tasks in an amphibious raid usually involve capturing an objective or objectives, holding them for a short period, and then withdrawing. Although these tasks are similar to those that are assigned in other operations, there are certain factors that are peculiar to amphibious raids and that affect the organization, tactics, techniques, and equipment of the raiding force.

a. Intelligence.--The detailed planning necessary for an amphibious raid requires detailed intelligence. The provision of a safety margin of

combat power, to compensate for lack of detailed intelligence, may detract from the raiding force's ability to achieve surprise and speed of execution. It poses additional problems in planning the landing and withdrawal of the raid force.

b. Speed.--The success of a force depends upon its ability to achieve its aim before the enemy has time to react to the full extent of his potential combat capabilities. The necessity for speed has a direct influence on the size, organization, and composition of the raid force. When either numbers of personnel or size and number of desired equipment appreciably slow the execution of the raid, the risk of employing such men and equipment is reevaluated in terms of the overall contribution they make to the execution of the raiding force mission.

c. Duration.--Raids are normally of short duration. Once the objective area is secured, it is not usually necessary to hold it for a protracted period. This enables the raiding force to be lightly equipped and to take what might, in other circumstances, appear to be unwarranted risks.

d. Surprise.--Surprise is important, not only with regard to the time and place of the assault but also to the size of the force that is landed. In the normal operational environment in which amphibious raids are conducted, bold action by small parties may confuse the enemy and make him unduly cautious.

e. Fire Support.--The amount of close fire support which the raiding force can expect in a raid is normally limited. This can be offset to some extent by relying on surprise, speed, and mobility.

f. Reserves.--In considering the problem of a reserve for an amphibious raid, a commander is faced with conflicting requirements. On the one hand, he must have a strong enough force to accomplish his mission. On the other hand, since his force must withdraw, he does not want to bring in any unit for which there is no definite task. A reserve for a raid may be provided in the following ways:

(1) A reserve may be designated and held in a state of readiness outside the objective area.

(2) A reserve may be landed in the objective area.

(3) The various elements of the raiding force may be augmented to provide for unforeseen contingencies.

(4) Units participating in the assault phase in missions that are not of a continuing nature may be earmarked as the reserve.

g. Withdrawal.--Withdrawal considerations affect all phases of planning. Withdrawal plans are flexible and are designed so that the raiding force can be withdrawn under any of the following tactical situations:

(1) In light contact, not surrounded.

(2) Surrounded, but in light contact.

(3) Under heavy pressure, not surrounded.

(4) Surrounded and under heavy enemy pressure.

h. Logistics.--Logistic outfitting of the raid force is primarily concerned with providing the minimum essential supplies and equipment required to carry out the assigned mission. Detailed planning and coordination are required because of the short duration and "one-shot" nature of the operation.

i. Deception.--Tactical deception is normally directed by the senior authority in the area of operations. It may be employed to assist the raid force commander in accomplishing his tactical mission with a minimum loss of men, material, and time. The tactical deception planning for an amphibious raid is initiated at the raiding force level to ensure that it supports the tactical plans for the raid. It should embrace deception that is local in character and that will sustain over a relatively short period of time a well-defined, tactical mission. The tactical deception plan is coordinated and approved at the amphibious task force (ATF) or higher level. In addition to the tactical deception plan, the area deception operation may be a deciding factor as to the time, composition of the force, concept of the operation, and method of withdrawal for amphibious raid operations.

1108. ORGANIZATION AND COMMAND RELATIONSHIPS

Experience during World War II and the Korean War of both U.S. and British forces clearly shows the advantages of controlling and directing all amphibious raids from the highest command in the area of operations. This does not mean that subordinate commands cannot or do not plan and conduct these raids, but area commanders are kept informed and, in effect, approve such raids to ensure unity of effort and coordination within the area of operations. Such control is necessary to avoid duplication and conflict between units which might interfere with each other. The principles of organization and of command relationships applicable to all amphibious operations apply to the amphibious raid. Command relationships for independent and supporting amphibious raids are depicted in figures 1 and 2. Overall command of the amphibious raid rests with the commander amphibious task force. Due to the unique nature of the missions that may be assigned and the resulting variations in the composition of troop and naval forces involved, the common superior specifies in his initiating directive the exact details of command relationships in each case. It is particularly important for the common superior to specify conditions under which basic plans may be changed, the raid delayed or aborted, and similar contingencies.

a. Commander Amphibious Task Force (CATF).--The commander amphibious task force exercises operational control over a raid attack group and various other task groups through their respective commanders. He may delegate his command authority over a raiding force commander to a subordinate Navy commander such as the operations of an advance force with a corresponding raiding force.

b. Attack Group Commander.--Regardless of the composition of the attack group, the commander is a Navy officer. He is the common superior of both navy forces and the raiding force. The relationship between this commander and his related raiding force commander is substantially the same as that between the commander amphibious task force and the commander landing force. While there may be a wide disparity in rank and age between these two commanders, each of them considers the opinion of the other, particularly in cases involving a decision requiring the exercise of professional judgment in their operational fields. However, since the raiding

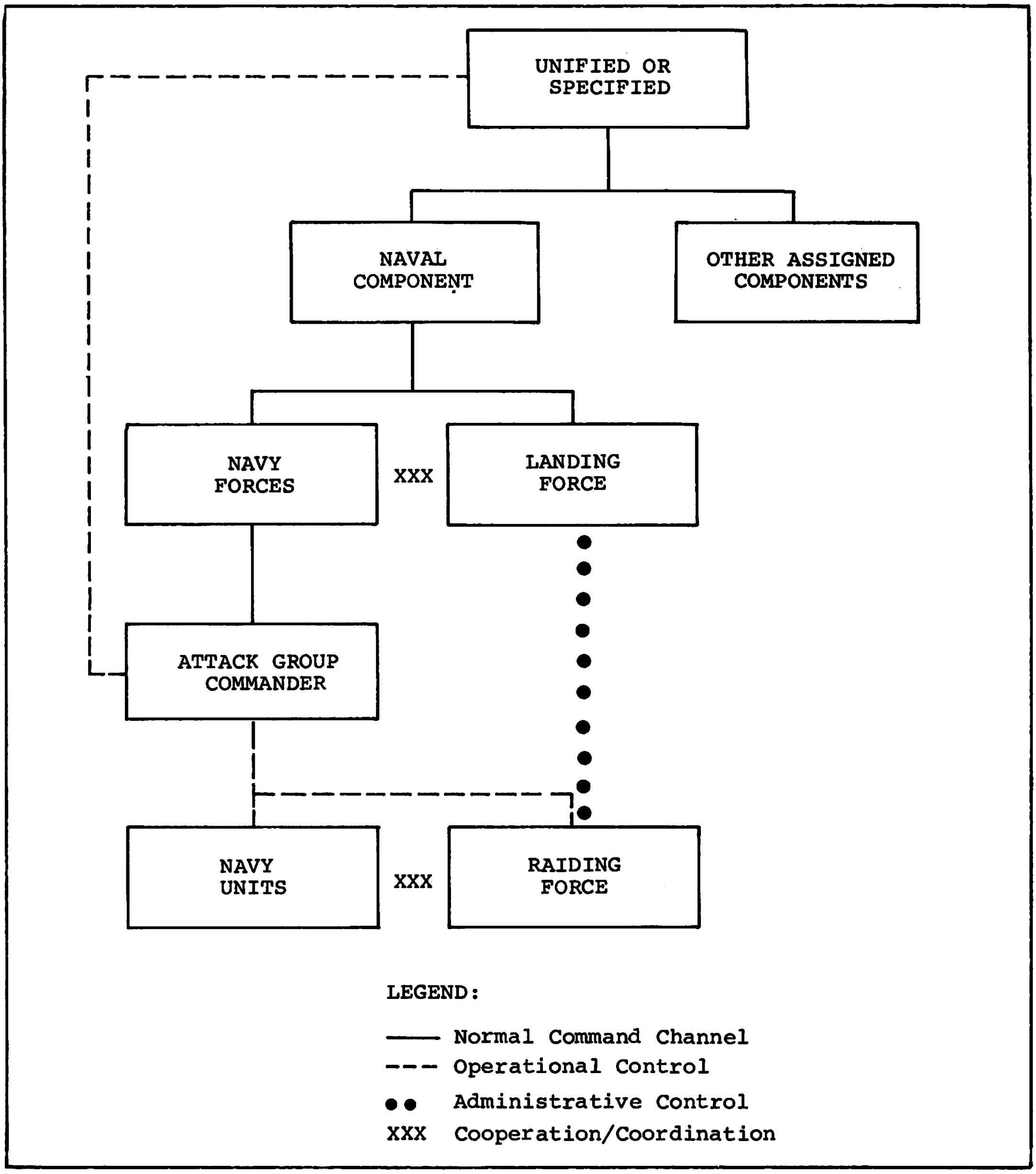

Figure 1.--Command Relationships for an Independent Amphibious Raid.

force is seldom established ashore, there are few cases in which command of the operation will be shifted ashore.

c. Raiding Force Commander.--Subject to the overall authority of the attack group commander, full responsibility for the conduct of operations ashore is vested in the raiding force commander. Since the immediate

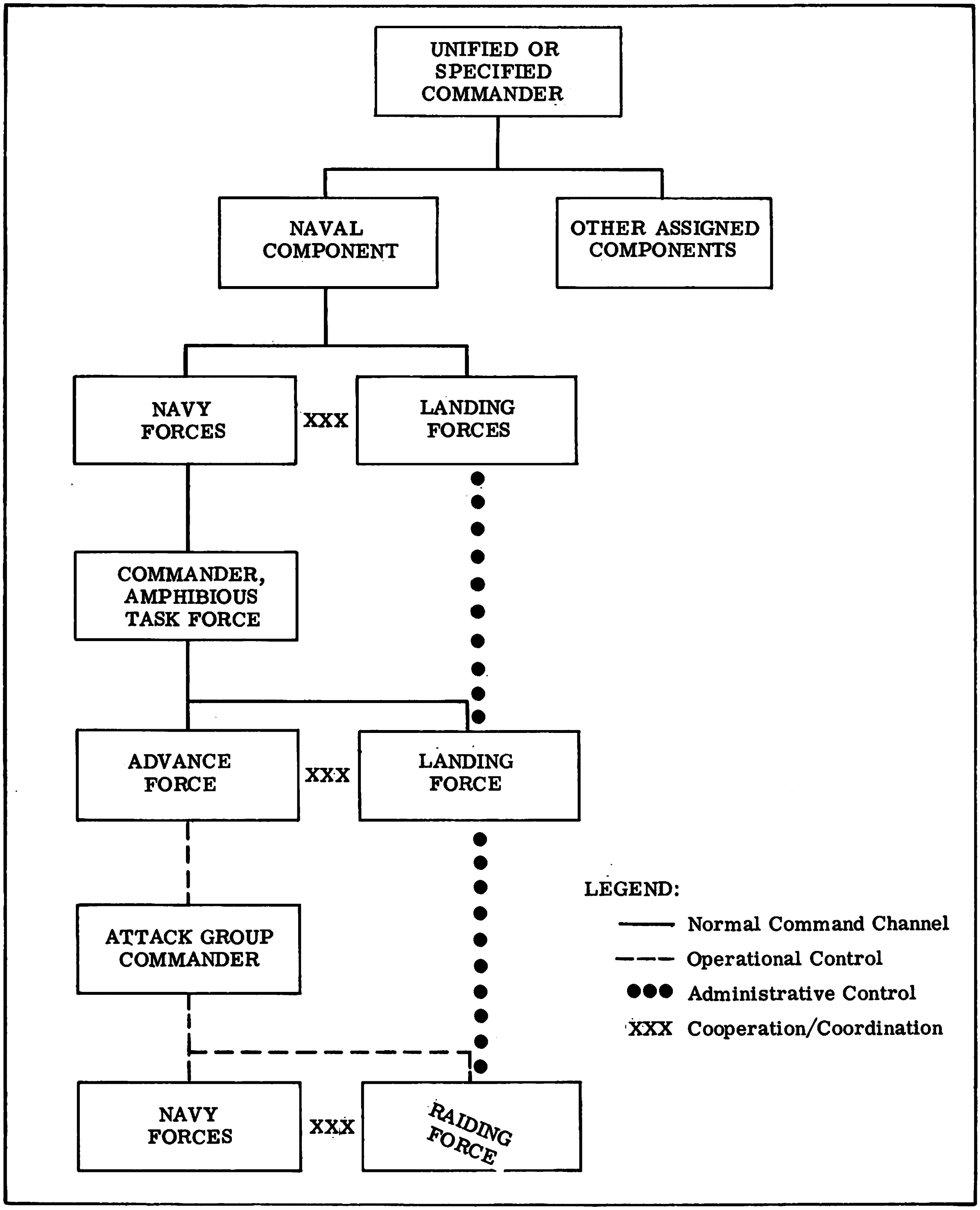

Figure 2.--Command Relationships for an Amphibious Raid Conducted in Support.

responsibility for the conduct of the raiding force operation ashore rests in the raiding force commander, the planning and, in most cases, the execution of the landing, assault, and withdrawal are primarily his concern. The feasibility of raiding force proposals is considered from the standpoint of the effect on the overall operation. The impracticality of providing necessary support is a valid reason for nonconcurrence in a plan or a proposed course of action set forth by the raiding force.

1109. RAIDING FORCE

Current Marine Corps organization and policy does not provide for any units specifically designated and/or trained as raiding forces. When and if the requirement to conduct amphibious raids is imposed upon a landing force, the requirement is met by task organizing and training a raiding force from existing landing force elements. The nucleus of such a raiding force is normally the infantry element; i.e., platoon, company, or battalion, whichever is appropriate for the assigned mission. The organization of the raiding force varies according to the missions assigned. When extensive raiding operations are to be conducted over an extensive period of time, a provisional organization may be established to provide for overall control, planning, and execution of raid operations. In a specific case, a battalion landing team (BLT), a task organized company, or platoon trained for the task may execute a one-time mission.

a. Mission.--The raiding force is given a simple mission which permits a flexible time schedule since decentralization is inherent in this type operation. Assignment of alternate missions is undesirable unless the object is to create a diversion. In this case, contingent missions may be assigned or permission given to engage targets of opportunity.

b. Size.--The size of a raiding force varies with the assigned mission. ATF and landing force planners estimate the smallest number of troops which can do the job. It should be pointed out that inferiority in numbers is less important in night raids.

c. Organization.--The task-type nature of a raiding force and the fact that all of its component elements are specifically tailored to carry out their assigned tasks may necessitate some departure from normal unit designations; i.e., platoon, company, and battalion. Organization of a typical raiding force is depicted in appendix A. No specific doctrine exists to resolve this situation. To retain flexibility, the commander of a raiding force is permitted to task organize the unit in terms of his assigned mission. A raiding force may consist of raiding groups, units, elements, or teams, or a combination of such units as may be required.

d. Functional Groupings.--The organization of a raiding force can be more clearly delineated in terms of its functional elements. In this respect, a raiding force may consist of a command and control element, a reconnaissance/security element, an assault element, a covering element, and a reserve.

(1) Command/Control Element.--The command and control element consists of the commander, assistant commander, and the administrative and communication facilities required to conduct the raiding operation. The raid force may or may not have an organic staff. When it is an independent force conducting a one-time operation, it requires a staff to plan and coordinate the operation. When the raiding force is part of a larger force

conducting extensive operations on a continuing basis, detailed planning may be developed and coordinated at a higher level and executed without a staff.

(2) Reconnaissance/Security Element.--The reconnaissance/ security element may land before the main body, screens/secures the landing beach or landing zone, and provides security observation posts (OP's) for these areas during the execution of the raid. In some instances, reconnaissance/security elements may execute reconnaissance missions in the objective area to select targets for projected raids.

(3) Assault Element.--The assault element is the combat element of the raiding force responsible for executing the mission of the raiding force. Normally, it effects its landing after the landing of the reconnaissance/security and covering elements and is the first element to withdraw and reembark.

(4) Covering Element.--The covering element lands after the reconnaissance/security element and occupies critical terrain features from which it can cover the advance of the assault element to the target and its subsequent withdrawal. Frequently, covering elements may be required to establish blocking positions along main routes of communication to interdict and delay the enemy's reaction capabilities. In such instances, the covering element is often more likely to become actively engaged with the enemy than the assault element.

(5) Reserve.--When employed, the reserve of a raiding force is similar to a reserve in other ground combat operations. Insofar as practicable, the raiding force is task organized to execute its assigned mission without a reserve. However, when a mission is particularly hazardous or vital, a reserve may be employed and landed with the raiding force. In other cases, a reserve may be retained afloat and landed only in case the raiding force needs assistance in accomplishing the mission or in disengaging.

e. Personnel.--Most well-trained Marines will qualify for the majority of raids conducted by regular Fleet Marine Force units. In addition to being well-trained, personnel in the raiding force should possess the following additional qualifications:

(1) Initiative and adaptability.

(2) Swimming ability.

(3) Stamina.

(4) Scouting ability.

(5) Aptitude for night combat.

(6) Language ability.

f. Equipment.--As individuals and units are screened and task organized to accomplish the raid mission, equipment is checked and tailored for the job. Anything which encumbers the force is taken only if its contribution is necessary to the success of the raid. Items of equipment for every contingency cannot be taken simply as a precautionary measure.

(1) When substituting weapons, provisions for adequate training are made so that personnel can employ these weapons effectively under the stress of combat.

(2) The size or shape of doors and hatches on aircraft or submarines may determine whether a piece of equipment is taken, a new piece of equipment procured, or a substitute item obtained.

1110. INTELLIGENCE

Accurate, detailed, and timely intelligence is essential to the planning and execution of an amphibious raid. The strong requirement for secrecy, stealth, speed, and surprise in the amphibious raid generates a need for more precise information than is required for a conventional amphibious assault. Sufficient information of the enemy and the area of operations is required to evaluate the adequacy of the proposed raiding force as organized and equipped, and to predict its relative probability of success or failure. In making a raid, a force has to take calculated risks, but planning a raid based on sketchy or unreliable intelligence increases the probability of failure.

a. Sources and Agencies.--All intelligence sources and agencies normally used in planning an amphibious operation are employed. Planners at each level of command carefully analyze available information to ensure that it is sufficient. Requests for additional information are initiated as soon as the need is determined, and the request can be expressed in precise terms to minimize collection efforts. Collection plans provide for continued gathering of information on the raid objective area until the raid is executed. Cross-checking information from two or more sources is fundamental.

b. Intelligence Requirements.--Intelligence requirements for the amphibious raid encompass terrain, weather, and hydrography; enemy defenses and patterns of action; and enemy reaction capabilities.

(1) Terrain, Weather, and Hydrography.--Intelligence requirements relating to terrain, weather, and hydrography in the target area include:

(a) Photographs of landing sites taken at low and high tide showing beach approaches and exits. New aerial photography which might reveal a special interest in the area is ordinarily ruled out. When practicable, ground photographs, views from boats, and periscope photography are obtained.

(b) Detailed weather forecasts to include cloud coverage for the designated period and the probable effects of weather on the actions of the raiding force and the enemy.

(c) Probable effect of expected wind, surf conditions, terrain, and vegetation on ability of the enemy to hear movements of the raiding party offshore and on the beach.

(d) Location of possible landing beaches and/or zones and relative evaluations of each.

(e) Detailed descriptions of routes of advance to the target area and the relative advantages and disadvantages of each.

(f) Description of the nature of any possible obstructions or hazards on beach approaches to include local currents as affected by the tide, types of bottom (lava, coral or sand), and precautionary measures which may be taken to circumvent them.

(g) Location and description of possible hiding places for boats and men in the area immediately accessible to landing sites and/or zones.

(h) Detailed description of local surf conditions to include any navigational hazards which may impede the ship-to-shore movement.

(i) Additional hydrographic charts or other printed information available on the beach approaches.

(j) Requirements for special equipment generated by terrain and weather in the area of operation; e.g., climbing equipment.

(k) Location of any soil or vegetation in the area that could prematurely reveal recent passage of the raiding party; e.g., muddy road surface, and indications of best places to cross coastal roads to avoid detecion.

(2) Enemy Situation.--Intelligence requirements relating to enemy defenses provide for a detailed analysis of enemy defenses in and around the target area to include:

(a) Strength and arms of enemy forces.

(b) Plans of the target installation in as much detail as possible.

(c) Nature and location of guard posts and routes; composition and frequency of patrols including the use of sentry dogs.

(d) Degree of alertness at night or off duty.

(e) Emplacements, trenches, fields of fire.

(f) Information on mines and other manmade obstacles.

(g) Communications or other warning systems employed by the enemy.

(h) Type of blackout discipline imposed.

(i) Existence of illuminating devices and intrusion detection devices to include mechanical, electronic, magnetic, infrared, seismic, and acoustic.

(j) Details of enemy routine, including off-duty routine.

(k) Purpose of all buildings and installations.

(3) Enemy Reaction Capabilities.--Intelligence requirements pertaining to the enemy's reaction capability demand a realistic estimate of the size and location of forces the enemy has available to reinforce the

target area, the speed with which the enemy can react once the raid is discovered, the routes which are available for this purpose, and the course or courses of action which the enemy is most likely to adopt. When enemy drills have been observed, a description of enemy tactics and defensive plans are included.

c. Dissemination.--The raiding force commander is kept abreast of the intelligence collection effort as it develops. He is also kept abreast of current and imminent friendly operations that may affect the execution of the raid. Action to gain information must not compromise security. Every effort is made to aid the raiders in making every aspect of the raid familiar to them, as the disconcerting effects of an unfamiliar environment detract from individual efficiency and group participation and coordination.

d. Counterintelligence.--Detailed counterintelligence planning and active counterintelligence measures are required in support of the amphibious raid. Strict security, secrecy, and isolation of the raiding force are required during planning, training, rehearsals, and movement to the target area.

1111. PLANNING STAFFS

Parallel planning for the amphibious raid is conducted concurrently by navy, air, and raiding force staffs.

a. Navy Planning.--The commander amphibious task force establishes overall command and control procedures for the amphibious raid. Planning by the naval staff establishes procedures for embarkation, movement to the objective area, landing, fire support, and the withdrawal. Naval planning delineates the craft in which the troops are to be transported and the place and time of embarkation. It also covers the composition and action of the naval escort and usually gives a rendezvous at sea within striking distance of the coast from which the actual approach to the landing place commences. Finally, it lays down arrangements for signals and communications between ships and shore and establishes recovery procedures for picking up personnel of the raiding force who may be stranded ashore after reembarkation is completed.

b. Air Planning.--Planning by staffs of air elements supporting the amphibious raid is concerned with tactical air operations to protect amphibious shipping, support the scheme of maneuver ashore, and cover the withdrawal and reembarkation. Specific targets for air attack are delineated in detail. Plans for air attacks are closely timed and coordinated with naval gunfire support planners to ensure that adequate fire support is available throughout the operation.

(1) During the movement to the objective area and the landing of the raiding party, it is normally sufficient to have shore or carrier based aircraft on call. The maximum air support is likely to be needed to cover the withdrawal.

(2) For each amphibious raiding operation, the pros and cons of an air attack before landing the raiding party are carefully balanced. Though a well-timed air attack inflicts casualties and damage and drives the enemy forces underground, it also keeps them awake and on the alert. When the raiding party can get ashore undetected, it is more likely to be

successful. Aircraft can, however, make a useful contribution toward surprise by drowning the noise of a landing. When this expedient is used, it is essential that "conditioning" flights be made for several nights beforehand within the same hour and covering a wide frontage of coast. By this means, the enemy will become used to hearing a regular air patrol and think nothing unusual on the night of the raiding operation. Once the raiding party has landed, air attacks are more usefully directed against the enemy's reaction capability. The use of delayed action bombs and other devices add to the confusion and diversion of enemy efforts to move reinforcements to the target area and assist in covering the withdrawal of the raiding party.

c. Raiding Force Planning.--Raiding force planning requires the latest and best information available as to actual conditions in the objective and target areas. As late intelligence arrives, alternatives and/or changes are made as necessary and coordinated with parallel naval and air planning staffs. The staff responsible for raiding force planning develops the same plans required for a normal amphibious operation. (See LFM 02, Doctrine for Landing Forces.) In addition, it establishes detailed instructions and procedures for the withdrawal of the raiding force.

1112. STEPS IN PLANNING

a. General.--The execution of the amphibious raid is normally concerned with:

(1) Embarkation, movement to the objective area, and the ship-to-shore movement.

(2) The movement to contact and the plan of attack.

(3) Withdrawal and reembarkation.

b. Steps in Planning.--There are normally nine major steps in planning the amphibious raid. Development of detailed plans for the raid are accomplished by following these steps:

(1) Study all available information.

(2) Plan attack of the target; consider the number of courses of action which will accomplish the mission.

(3) Plan movement from landing zone or beach to the target.

(4) Plan withdrawal.

(5) Plan ship-to-shore movement.

(6) Plan embarkation and movement to objective area.

(7) Plan reembarkation.

(8) Plan supporting fires.

(9) Prepare task organization and equipment list.

c. Study All Available Information.--Planners initially analyze current information of the enemy situation, the objective area (terrain,

weather, hydrography, local communication systems), and the attitude of civilian inhabitants. Recent, concurrent, and imminent operations by other friendly forces are considered in detail.

d. Plan Attack of the Target.--The raid mission establishes the general scope of action during the attack of the target; e.g., whether total or partial destruction is to be accomplished, removal of specified equipment, capture of prisoners, etc. The raiding force is organized into task elements to achieve maximum flexibility and to reduce troop requirements to the essential minimum number. Each group is precisely tailored to accomplish a specific task in support of the general plan of attack. As a minimum, forces are usually organized to eliminate enemy security, attack the target, and cover the withdrawal. Plans for attack of the target are simple, easy to execute, and within the capabilities of the raiding force.

e. Movement From Beach or Landing Zone to Objective.--Plans are made to ensure that the assault element can reach the target intact. To accomplish this, one or more covering elements are employed to neutralize and contain any enemy opposition that attempts to interfere with the target task group. The composition of each covering element depends on the task assigned and the expected resistance it will encounter.

f. Withdrawal.--The withdrawal normally commences immediately after the mission has been accomplished. It is part of and the final step in the scheme of maneuver. The withdrawal is carefully planned. At this stage of the operation, the intensity of the raiding troops' offensive spirit tends to decline. The capture of the target alerts the enemy, and he can be expected to react vigorously. For these reasons, the commander ensures that the withdrawal is executed rapidly and systematically. Raid elements withdraw along predesignated routes and in a specified sequence except when the raid commander orders a change. Plans include provisions for certain elements to cover the withdrawal and to conduct delaying actions if the enemy pursues. Maximum use is made of available naval gunfire and air support to cover the withdrawal and reembarkation. As is true of other phases of the raid, plans for the withdrawal include alternate provisions as to time, routes, and sequence of movement to reembarkation points and/or landing zones.

g. Ship-to-Shore Movement.--Planning for the ship-to-shore movement is generally similar to that for the amphibious assault. Due to the simplicity of plans, the smaller scale of the raid, and proficiency gained during rehearsals, control ships and lines of departure are seldom used. The ship-to-shore movement is rehearsed in detail under conditions similar to those in the objective area to ensure proper timing and coordination.

h. Embarkation and Movement to the Objective Area.--Embarkation and movement to the objective area are planned in accordance with standing amphibious procedures. Speed and/or movement in periods of reduced visibility are emphasized to maintain the element of surprise. Appropriate antiair warfare and antisubmarine warfare measures are planned to protect the attack group during this phase of its operation.

i. Reembarkation.--A reembarkation point or points are selected during planning of the scheme of maneuver. While a raiding force may reembark at the same point where it landed, circumstances may sometimes require that the reembarkation be made at a different beach or landing zone than the landing. Withdrawal from the objective area by air may be possible

when enemy resistance has been sufficiently reduced or eliminated. Air withdrawal may be necessary when enemy air or naval action forces amphibious shipping to withdraw from the area. Alternate reembarkation points or pick-up zones are selected, and provisions are included in raid plans for shifting to these in emergencies. Once the operation begins, the original point is not changed unless it is essential to do so. Plans are made for subsequent recovery of persons unable to reembark with the main body of the raiding force.

j. Supporting Fires.--The general principles underlying the use of naval gunfire and air support during amphibious operations apply to the amphibious raid. Fire support plans must be coordinated with development of the landing plan, scheme of maneuver, and the plan for reembarkation.

k. Task Organization and Equipment List.--After detailed plans are developed concurrently by raiding force, air, and naval planning staffs, requirements for troop units, specialists, and support can be accurately determined. The raiding force is organized into specific task groups commensurate with the number and nature of subordinate units involved. Tables of organization are adhered to as much as possible. However, some deviations are inevitable due to the necessity for tailoring task groups to the specific tasks assigned. Based on the organization of the raiding force, lists are prepared of the specific equipment, weapons, ammunition, and supplies to be carried by each subordinate group.

1113. SCHEME OF MANEUVER

After all intelligence on the area and the enemy has been assembled, the size and type of raiding force are determined concurrently with the plans for attacking the objective. In developing the scheme of maneuver, the selection of the landing beaches or landing zones is of particular importance. The beaches or zones selected should permit easy access to the objective; however, if surprise is of paramount importance, a less suitable beach or landing zone, or one more distant from the objective, may be chosen.

a. The raiding force is given a simple mission which permits a flexible time schedule since decentralization is inherent in this type operation. Assignment of alternate missions is normally undesirable unless the object is to create a diversion. In this case, contingent missions may be assigned or permission given to engage targets of opportunity. However, the assignment of tasks to subordinate elements of the raiding force should be such that failure to accomplish one task will not cause the entire operation to fail.

b. A covering force element may be designated to prevent enemy action from interfering with the main body's attack of the objective and withdrawal.

c. The withdrawal is the final step in the scheme of maneuver. Factors considered in planning the withdrawal are: the time required to attack and reduce the objective, the expected enemy reaction, the delay resulting from enemy reaction and friendly casualties, and availability of a covering force. Reembarkation points are selected as part of the scheme of maneuver. Once the operation begins, this point is not changed unless it becomes absolutely necessary, since change at any time during the raid is confusing and may result in disaster. While a raiding force may

reembark at the points at which it lands, circumstances can dictate that a different point or beach be designated. When the raiding force lands on a small island or on a narrow peninsula, consideration is given to reembarking on the opposite side. In addition, landings or withdrawals by water may be combined with air entry or evacuation.

1114. TRANSPORTATION

The raiding force may be transported into and out of the objective area by surface or subsurface shipping and transport aircraft or by a combination of these means and landed by helicopter, landing craft, inflatable boats, and/or parachute.

a. For large-scale raids, conventional transports which can approach at relatively high speeds and load and unload rapidly are used.

b. For raids by small units, transport aircraft, the high speed transport ship, or the transport submarine are well suited.

c. Once within the range of the target, raiders may be landed by a number of means including:

(1) Helicopters.

(2) Landing craft.

(3) Inflatable boats.

(4) Swimmer delivery vehicles.

(5) Parachute.

1115. CHOICE OF LANDING PLACE

a. Beach Selection.--In the choice of a landing place, all possible beaches are examined to find a beach which allows for a surprise approach from the sea and a landing in calm water. The latter is especially desirable although it usually increases the difficulty of effecting surprise. Sheltered waters are usually enclosed in a bay or in the lee of islands so that ships run a risk of being spotted as they approach and intercepted as they return. They may also be protected by minefields. Normally, landing places are avoided which cannot be approached from several different directions. Other factors considered in beach selection include:

(1) Conformance with the scheme of maneuver.

(2) Probability of gaining surprise.

(3) Enemy dispositions.

(4) Distance to target.

(5) Sea approaches, beach characteristics, and beach exits.

(6) Equipment to be moved over the beach.

(7) Availability of cover and concealment.

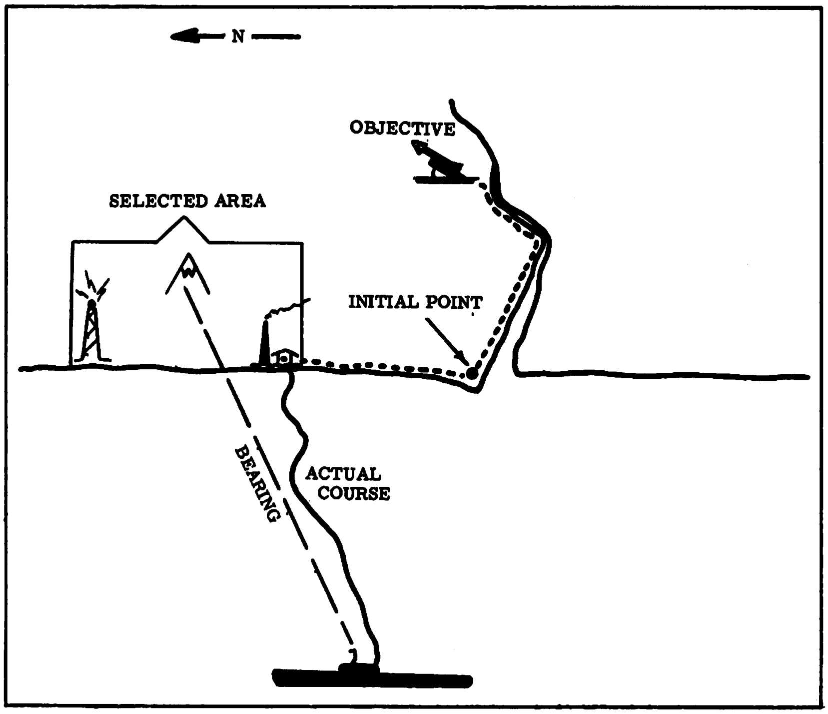

Figure 3.--Selection of Initial Points.

b. Raiding Force Orientation.--A major consideration in beach selection is determining an initial point for raiding force orientation ashore. The location of this point must be known precisely, with respect to the beach/zone and to the objective, and be one that is easily recognized such as a river mouth or bridge across a river. The relationship between this point and the beach/zone is that the raiding force landing anywhere in the vicinity of the landing beach/zone must first move in a specific direction to find this initial point. (See fig. 3.) The landing beach/zone itself should be large enough to allow for minor errors in predicted drift of parachutists, swimmers, or boat teams.

c. Landing Beaches.--The final selection of a coastal landing beach usually involves a compromise between a beach which permits easy landing, with some risk of detection, and one which provides maximum security at the risk of a difficult or hazardous landing. Examples of each are the wide, flat, sandy beach backed by an easily traversed hinterland and the narrow, steep, rocky beach backed by cliffs.

(1) A predominant factor to be considered is surf state. Hydrographic offices should be consulted for up-to-date information.

(2) In general, preferred surf conditions exist when ocean waves break in a single breaker line about 200 feet from the beach and the intervening space contains several foam lines which dissipate the force of the surf. The least desirable surf conditions exist when several breaker lines are present or when a single breaker line spills directly onto the beach. The depth of a breaking wave on an evenly sloping beach is approximately 1.3 times the height of the wave. When a bar is present, it may cause the waves to break in water up to 1.7 times the height of the wave.

(3) The characteristics of the surf on a given day are based upon the nature of the bottom, the direction and speed of the wind, the distance between successive swells (wave length), the state of the tide, and the nature of the currents. Some of the factors to consider when predicting relative surf characteristics are:

(a) Offshore shoals, ledges, and rough bottom contours tend to reduce the surf.

(b) Offshore islands tend to break up ocean swells and produce several patterns of smaller waves.

(c) Kelp or any variety of dense seaweed reduce wave height.

(d) Swift currents flowing in the direction of wave advance and onshore winds reduce wave height.

(e) A reef face or other abrupt break in the bottom may cause each wave to break up into smaller waves.

(f) A submarine ridge perpendicular to the coast increases wave height; conversely, a submarine canyon reduces wave height. The use of a submarine canyon or trough close to the beach may reduce or eliminate wading through shallow water and/or surf. Indications of such troughs should always be looked for when landing by landing craft or small boats.

(g) A steep bottom causes waves to break rapidly and close to or directly onto the beach accompanied by violent wave uprush.

(h) A flat bottom causes waves to break gradually and at a greater distance from the beach with several foam lines being formed between the breaker line and the beach.

(i) A sand bar parallel to the beach causes waves to peak up or break depending upon the depth of water over the bar. A single breaker line may form over a bar while another breaker line forms closer to or on the beach. The presence of several bars may cause multiple breaker lines. Sand bars are frequently found off sandy beaches exposed to wave action.

d. Inland Landing Zones.--The choice of an inland landing zone is also usually based on a compromise between ease of landing and security. A raiding force may be landed inland by debarking directly from helicopters. The major factor considered when selecting the landing zone is the presence of obstacles that restrict helicopter operations. Available landing zones should be sufficiently large to accommodate major elements of the raid group at a single touchdown. They should be relatively close to the target, offer several good routes to and from the target, and facilitate the organization of a perimeter defense by reconnaissance/security elements of the raiding force.

1116. SELECTION OF DATES (TIDE FACTORS)

When the raiding force conducts a waterborne ship-to-shore movement, the first combination of suitable moon and tide normally fixes the date of the operation to 3 consecutive days. As a calm sea is desirable, the first

of these 3 days may be selected in order to leave 2 alternate days in case of bad weather.

a. Moon.--The moon helps most when it is due to rise on the landward side soon after the raiding party is ashore. This allows the ships and boats to approach in complete darkness with landmarks faintly silhouetted against the glow which precedes the rising moon. Later, the raiders advance into an increasing glow of moonlight which helps to show them the way and make a silhouette of an approaching enemy. Finally, the moon may still be low enough to let the ships get away in comparative darkness.

b. Tide.--Favorable tide conditions are a matter of choice and vary with different types of coast, though it is generally better to land with a rising tide. The reembarkation also needs a rising tide. All other factors being constant, the Navy prefers to land on a rising tide to reduce the stranding of landing craft above the water level. The raiding force commander will do well to consider a landing at low tide. The defensive arrangements at night; i.e., fixed lines of machineguns, etc., usually are designed to catch landing parties somewhere near the high watermark. Accordingly, if the landing is made at low tide, there is a fair chance of gaining surprise. In such a landing, there may even be space to deploy before the advance and to maneuver in order to flank likely enemy machinegun positions in the landing area. The farther out the tide, the less chance there is of the landing being seen or heard by the normal shore posts. The risk of running into underwater entanglements is also reduced to a minimum. The chief disadvantage of a landing at low tide is the loss of time. It may add as much as a mile of distance to the beach, and the raiding party may have to wade from the boats and back.

1117. TIMING THE OPERATION

Timing depends on whether the whole raid is to be completed during one night or the troops are to remain ashore and be taken off during a following night. In a thickly garrisoned country with good communications, it is necessary, as a rule, to take the raiding party off the same night. In such cases, it may be taken as a rough guide that ships should be outside the range of enemy artillery during daylight. Normally, the landing force plan and withdrawal are completed under the cover of darkness. Ordinarily, this does not allow the raiding party an overabundance of time to accomplish its assigned mission ashore. On a short summer night, there may be as little as 3 hours left after allowing for disembarkation and reembarkation. It is unsafe to allow less than an hour for each mile to be covered ashore. The time schedule should also allow for unforeseen delay. All times should be checked and verified in a number of rehearsals approximating actual conditions expected during a raid.

1118. FIRE SUPPORT

Fire support planning for an amphibious raid is similar to that for an amphibious assault. Since surprise is a major factor, supporting fires are usually withheld until surprise is lost.

a. Fire Support Means.--Air and naval gunfire are the principal means of fire support available to the raiding force. Heavy ground fire support means; i.e., artillery and tanks, are normally not landed as part of, or in support of, a raid force. The coordination of fire support means is delineated in FMFM 7-1, Fire Support Coordination.

b. Employment

(1) Ship-to-Shore Movement.--Normally, the landing of a raid force is accomplished by stealth. Supporting fires will be planned but are not employed at this phase unless unforeseen circumstances necessitate aborting the mission.

(2) Attacks on the Objective.--Air and naval gunfire may be used for preparatory fire. During and after the attack, it may be shifted to targets which constitute the greatest threat to the mission accomplishment (e.g., assembly areas, roads, bridges which could be used by reinforcing enemy troops, enemy artillery, or rocket positions which could place fire on friendly positions).

(3) Withdrawal.--Air and naval gunfire support may be required to cover the withdrawal of the raiding force to their reembarkation area, and the subsequent withdrawal of the entire raiding force. Such fires are designed to screen the elements of the raiding force and to preclude their being intercepted by the enemy as they disengage and effect their withdrawal.

c. Fire Support Coordination.--A series of no-fire lines proceeding back from the target area to the beach or landing zones may be established. Withdrawing elements of the raid force inform the raid commander as they clear successive lines. All fires covering the withdrawal are approved by the raid commander. When feasible, they are observed and controlled by the raid element requesting them.

d. Fire Plans.--Detailed fire support plans are prepared to cover all phases of the operations and foreseeable emergency contingencies; i.e., aborting of the mission at an early stage. Such plans are prepared in accordance with the procedures delineated in FMFM 5-1, Marine Aviation; FMFM 7-1, Fire Support Coordination; and FMFM 7-2, Naval Gunfire Support.

1119. SHIP-TO-SHORE MOVEMENT

Planning for the ship-to-shore movement is generally similar to that for an amphibious assault. This is especially true in large waterborne or helicopterborne raids. However, in all cases, the general unloading period of the ship-to-shore phase is deleted. The usual control ships and lines of departure off landing beaches are normally used only for large-scale raids.

a. The method selected for the ship-to-shore movement should be that which will land the raiding force with the least probability of detection on or as close to its objective as possible, as simply and rapidly as possible.

b. Night landings or landings under reduced visibility are common. The raiding force emphasizes other techniques which preserve surprise. These include communication restrictions, late deployment of landing craft, and alternate plans for changing landing beaches in the event of discovery. Consideration is also given to the possibility of landing either a pre-H-hour landing party or the first troop waves in rubber boats to seize initial objectives and to cover the remainder of troops landing in conventional types of craft.

1120. WITHDRAWAL AND REEMBARKATION

Withdrawal normally commences immediately after the mission has been accomplished. It is the final step in the scheme of maneuver. At this time, the spirit of the offensive declines, and enemy reaction may be more violent than during earlier phases of the raid. Consequently, the greatest threat to the survival of the raid force may exist at this time. The withdrawal phase must be well planned, rehearsed, and coordinated. The various task elements withdraw along predesignated routes and in a specified sequence. This sequence provides for task elements to cover the withdrawal and to conduct delaying actions if the enemy pursues.

a. Factors considered in planning the withdrawal are the time required to attack and accomplish the mission, the expected and unexpected enemy reaction, the delay anticipated because of this reaction, and the foreseeable casualty load. While a raiding force usually withdraws to the same point at which it landed, circumstances may dictate that a different landing zone or beach be designated. In addition, landings or withdrawals by water may be combined with air entry or reembarkation. Therefore, the selection of the withdrawal point is an important consideration during planning of the scheme of maneuver. Once the operation begins, this point is not changed unless it becomes absolutely necessary. A change at any time during the raid is confusing and may be disastrous. Routes to the withdrawal point are selected which facilitate movement and are at the same time easily identified. Preferably, they are behind terrain that affords protection to personnel withdrawing and offer several good positions from which covering elements may block enemy counteractions.

b. The withdrawal plan is flexible, to include alternate provisions, as to both time and place for embarkation. If the landing beach/zone and withdrawal beach/zone are not the same, positive means of location and identification are established. If employment of nuclear demolitions is contemplated, plans are made to avoid the hazards of residual radiation. Special situations may permit planning for the withdrawal of the raiding force directly into territory of either friendly regular or guerrilla forces. Withdrawal by air is considered when facilities and aircraft are available and withdrawal by ship is more dangerous.

c. Surf characteristics during the withdrawal are evaluated in the same manner as for landing the raiding force. The state of the tide and its effect on the surf are considered when selecting an exact time for withdrawal.

d. Alternate plans for withdrawal include provisions as to routes and sequence of movement during the withdrawal, alternate methods of shore-to-ship movement, or air withdrawal vice coastal withdrawal. Alternate times are selected in the same manner as primary times and usually occur at approximately 24-hour intervals.

e. Withdrawal and reembarkation proceed concurrently until the last man and piece of equipment are reembarked. The psychological impact is much more effective if the raiding force disappears without a trace. However, equipment that cannot be withdrawn is destroyed.

1121. LOGISTICS

Logistic planning for the amphibious raid is concerned with providing the minimum essential support required to accomplish the assigned mission. Detailed planning and coordination are required because of the short duration and "one-shot" nature of the operation. The raid force will have

little, if any, opportunity to correct or compensate for mistakes in logistic plans.

a. Supply.--Supplies carried by the raiding force are restricted to a prescribed load established in planning and tested in actual rehearsals. The load of raid force elements is lightened to a minimum considered consistent with the execution of the assigned mission.

b. Resupply.--Usually there is no resupply of a raiding force. However, airdrop of class I and class V items may be necessary if the enemy succeeds in prolonging the withdrawal of the raiding force. In rare cases, it may be possible to preposition supplies or equipment by clandestine means prior to the actual raid.

c. Critical Items.--All equipment to be taken on the raid is evaluated in terms of its contribution to the overall raid mission. Items critical to the execution of the mission are isolated in planning. Such items are given detailed maintenance checks to ensure that they are in good working order. When feasible, additional quantities of critical equipment may be landed or carried in amphibious shipping as "insurance items."

d. Maintenance/Modification.--All equipment used by the raiding force is inspected frequently and tested under actual raid conditions during rehearsals. Standard equipment may be modified as necessary to cope with the special conditions of its use during the raid. Special equipment may be improvised or manufactured when necessary to meet special requirements generated by the nature of the raid. It is extremely important that the raiding force have the exact types of equipment required to carry out its combat tasks ashore.

e. Vehicles.--Lightweight, air transportable vehicles may enhance the mobility of a raiding force and permit it to move rapidly into position, execute its attack on foot, and withdraw from the objective. However, the nature of most amphibious raids limits the requirement for ground transportation. As a raid force increases in size, its supply requirements increase and ground transportation support may become an important consideration.

f. Combat Service Support.--Logistic plans provide for furnishing appropriate combat service support personnel to the raiding force. Such support consists of engineers (principally demolitionists), shore party personnel, and helicopter support team personnel. Such assignments are made early in planning so that these personnel can participate in the full training and rehearsal cycle.

g. Medical.--Medical support is primarily concerned with evacuation and immediate treatment. The medical officer aboard ship exercises technical medical supervision over the entire raiding force. Sufficient corpsmen train and land with the raiding force to cope with the foreseeable casualty load ashore. To the degree feasible, casualties are evacuated as early as practicable by the fastest means available. If helicopters will not be available throughout the raid, and LVT's are used, a mobile aid station should be set up in one of these, particularly in chilly weather.

1122. TRAINING

Landing force, naval, and air elements detailed for the amphibious raiding operation meet for combined training as early as possible. It is

very important to have the same boats/helicopters and crews for both the training and the operation and to keep the same group of Marines with the same boats/helicopters throughout. One of the main objectives of the training period is to rehearse the raid under conditions approximating, as nearly as possible, those which will be met during the operation. Night raids may require more training. Special training under as many different conditions as possible so as to be prepared to meet the varied conditions at the raid area may be required. Every effort is made to rehearse the landing on a piece of coast which is like the one chosen for the attack. To prepare for the landing action, the chief aim is to develop a highly trained force and familiarize them with the ground over which they are to operate.

a. Unit Training.--Major emphasis is placed on unit training. Unit training as discussed here means the training of the task organization assigned to the mission. Normally, units and individuals complete appropriate amphibious training prior to assignment to a raiding force. In general, units and commanders are selected for their experience as a coordinated team, their morale, and their previous combat experience.

(1) Integrated training with specialists, naval units, and supporting forces commences as early as possible, As a guide, 30 days of training are normally required to adjust the raiding force to special climatic conditions of an objective area when it differs materially from the one in which they normally operate.

(2) During the training cycle while the individual is improving his skills, the unit is specifically training for its mission. The maxim that "practice makes perfect" is especially applicable to training for raiding. Individuals, task groups, and the force itself are drilled until every aspect of the raid plan becomes an automatic process. Troops are uniformed and equipped in the exact fashion required for the raid. Opposing troops are employed to accustom the force to operate, while training, as they must during the raid and to test their proficiency. Training frequently extends to periods where the raiding troops are subjected to extreme physical and mental strain.

b. Individual Training.--Individuals selected are experienced infantrymen, schooled in basic subjects, and possess the special skills required for the accomplishment of the mission and/or the specific tasks. Prior to assignment, personnel are screened for physical, medical, and mental defects which would hinder their performance. Individuals undergo a rigid physical hardening process to enable them to accomplish missions calling for the utmost in physical stamina and to weed out those individuals who are physically and psychologically unqualified. Normally, the raiding force begins training slightly overstrength. Individuals separated from the raiding force during training as well as administrative support personnel are kept in isolation until completion of the mission.

(1) Separation of individual training and unit training are minimized. Individual skills are improved while undergoing unit training. Refresher training in basic subjects, especially applicable to the raid, is often necessary. This may include amphibious training; swimming; helicopterborne operations; hand-to-hand combat; and escape, evasion, and survival training.

(2) Subjects in which special training is most often necessary include night operations, passage of obstacles, physical training that

develops stamina; use of communication means to be employed during the raid; and collection of intelligence data. Each individual must be thoroughly familiar with his own role in the operation and how it relates to the overall plan. Experience also has proven the importance of having every man oriented on the complete plan of operation. Training of individuals in the raiding force should ensure that:

(a) Individuals complete basic amphibious training.

(b) Refresher training in basic subjects especially applicable to the raiding plan is accomplished.

(c) Special training is provided in rubber boat handling, demolitions, use of enemy weapons and equipment, cliff-scaling techniques, and operation of special equipment and arms.

c. Recognition Training.--Recognition in the dark is one of the greatest difficulties, particularly when the time comes for reembarkation. By this time, the withdrawing raiding party may be mixed up with hostile patrols, and enemy craft may even get in among the raiding party's boats. A password is some help, but no real solution, as men have to get very close to recognize the password above the noise of the waves. Flashing of lights is far too dangerous except by a few selected leaders, and unauthorized flashlights are not permitted. The best means of recognition are some very distinctive headgear or an agreed arm signal. Another system is to issue the men a pair of luminescent discs to be tied on the belt in front and behind. These discs are made either square, round, or triangular so that the recognition mark can be changed for each operation. If practical, the employment of night observation electronic and optical devices should be considered in passive and active modes. Recognition systems and techniques should be integrated into all training and rehearsals as soon as practicable to ensure that all members of the raiding force are completely familiar with their use prior to the projected operation.

1123. REHEARSALS

Rehearsals assume even greater importance in preparation for amphibious raids than for other types of amphibious operations. Thorough, integrated rehearsals are required to obtain precision and speed in the execution of a raid. All participating forces are drilled in every detail of debarkation, movement ashore, operations ashore, withdrawal, and reembarkation. Timing, so vitally important in the amphibious raid, cannot be accurately estimated or adhered to without adequate rehearsals of the entire raiding force. The purpose and conduct of rehearsals for amphibious raids are similar to that for the amphibious assault. They are conducted to verify time and space factors for each phase of the raid; to ensure proper timing; to familiarize personnel with the operation plan and special equipment and techniques to be employed; to measure proficiency of the individuals, elements, unit, and group; to develop coordination, resolve problems, and suggest necessary changes; and to incorporate all previous modifications to the plan.

a. Rehearsal Requirements.--An early and generous supply of charts, maps, and aerial photographs; a large-scale sand table model; and a scheduled rehearsal area, flat or hilly depending on the target area, are required. A full-scale replica of the target area is constructed, road and tracks taped out, and buildings represented. Troops are repeatedly

rehearsed in the dark, and movements from point to point are carefully timed. The success or failure of the whole operation depends upon the rehearsing done before the operation, and every conceivable effort to achieve realism enhances the probability of success. During rehearsals, requirements for special equipment are normally generated such as scaling apparatus and/or special demolition kits. Accordingly, it is well worthwhile making full-scale models for troops to practice on.

b. Testing of Plans.--During rehearsals, the plan for the amphibious raid is evaluated and checked to ensure that it will not backfire. The concept of operation, task organization, and scheme of maneuver are examined in turn:

(1) Concept of Operation.--The concept of operation is tested in terms of the following criteria:

(a) Is the plan as presented realistic under conditions portrayed?

(b) Is the plan sufficiently bold in concept?

(c) Have all available resources been exploited?

(d) Have existing policy restrictions been considered?

(e) Is the principle of surprise properly exploited?

(f) Are the reasons for selecting H-hour valid?

(g) Has the problem of withdrawal been considered objectively?

(h) Have plans been adequately tested and rehearsed?

(2) Task Organization.--The task organization is tested in terms of the following criteria:

(a) Is the raiding force of proper size?

(b) Have existing T/O organizations been used where feasible?

(c) Has adequate consideration been given to eliminating personnel not necessary to the mission?

(d) Is an adequate reserve provided for?

(3) Scheme of Maneuver.--The scheme of maneuver is tested in terms of the following criteria:

(a) Are logical objectives or tasks assigned to subordinate elements?

(b) Do all objectives assigned contribute to the basic mission?

(c) Has enemy reaction been realistically considered?

(d) Do landing areas put troops on the beach/landing zone in the best place to accomplish the various missions or tasks to be performed?

(e) Have all phases of the operation been considered?

(f) Is the time available adequate to land, attack the target, and withdraw and still not subject the raiding force to unnecessary risks?

1124. SECURITY

Once training starts, the maintenance of secrecy is a difficult problem. It will be virtually impossible to conceal the fact that a landing operation is being planned. Efforts are concentrated only on keeping secret the size, date, and place. There will be no need for anyone to know the date until the time comes to move to the point of embarkation. Secrecy regarding the destination conflicts with the vital necessity of familiarizing the troops with the ground over which they are to operate. The best way of ensuring secrecy is to keep participating elements in isolation during the rehearsal period with no contact at all with the outside world. This will not always be possible, and it will leave the problem of concealing the departure of personnel from the area. A good deal of ingenuity is needed to accomplish a secret departure. Phasing troops and equipment to embarkation areas, especially in periods of darkness, will assist in alleviating this problem.

1125. GUERRILLAS IN SUPPORT OF AMPHIBIOUS RAIDS

The command relationships and general principles underlying use of guerrillas in support of amphibious operations apply when employing guerrilla assistance in support of an amphibious raid.

a. Control.--Operational control of friendly guerrilla forces is assigned to the commander landing force when he assumes responsibility for operations ashore. This may not be effected easily. It depends on the reliability of the guerrilla commander and his subordinates as well as their desires. Due to the exigencies of politics, military situation, and the capabilities of the guerrilla force, the theater commander may issue guidance and possible limitations on the initial assistance that may be expected from the guerrilla force.

b. Mission.--Missions developed for a guerrilla force may closely parallel those assigned to the raiding force. The guerrilla mission is influenced by the following factors:

(1) Capabilities of the guerrilla force.

(2) Capabilities of the enemy in antiguerrilla actions.

(3) Reliability of the guerrilla force; e.g., has the enemy been able to penetrate the guerrilla organization? If so, at what levels?

(4) Personality of the guerrilla commander.

(5) Availability of supplies.

(6) Security of the guerrilla base.

(7) Guerrilla rivalries.

(8) Enemy retaliation against friendly civilians.

c. Guerrilla Assistance.--Guerrilla assistance in support of an amphibious raid may consist of:

(1) Reconnaissance Screens and Patrols.--Guerrilla forces can provide an effective screen to the flanks and front, locating and temporarily isolating enemy positions. Prior to an amphibious raid, they may conduct early reconnaissance. During the raid, they may be used as guides. After the raid, they may assist in escape and evasion.

(2) Supporting Attacks.--Supporting attacks may be conducted in the following ways:

(a) Ambush.--The guerrillas can support the main effort by ambushing enemy troops who are attempting to reinforce the main target. The avenues of approach for reinforcing enemy forces can be cut, obstructed, or mined by the guerrillas.

(b) Raids.--The guerrillas may conduct raids in support of the main attack. These supporting raids may be directed against enemy headquarters; communication facilities; personnel (e.g., commanding generals); small units; isolated outposts; and supply, ammunition, or POL dumps.

1126. NIGHT LANDING TECHNIQUES

The execution of a night landing as part of an amphibious raid does not require any departure from basic amphibious doctrines set forth in LFM 02, Doctrine for Landing Forces, nor does it require any substantial variation in landing force techniques. However, certain essential considerations require added emphasis.

a. Selection of Objectives, Landing Zones, and Landing Beaches.--Planning for a night landing by the raiding party requires simple and effective control measures for the conduct of the ship-to-shore movement, landing, and movement to the raid objective. The landing points should be easily identifiable under all conditions of visibility. The distance to the raid objective from the landing zones or beaches should be reasonably short. Terrain features in the area should be such as to facilitate the movements of the raiding party to its assigned objective.

(1) Routes of egress from landing zones and/or beaches should be readily accessible and approaches to the raid objective well defined and easy to negotiate.

(2) Landing beaches are selected so as to be readily identifiable from seaward. They may be narrower than for a daylight landing since individual boat waves consist of a minimum number of craft to ensure effective control.

b. Navigation and Control.--The landing of the raiding party at the precise time and place is especially important as it is the basic reference point for the planned raiding operation ashore. The employment of helicopters for the ship-to-shore movement in a night operation is often

predicated on the capability of helicopters to set down in a specific, relatively small, undeveloped site or zone. Helicopter and surface ship-to-shore movement plans need to be simple and involve a minimum of directional changes.

c. Training and Rehearsal.--The detailed coordination required in an amphibious raid conducted at night necessitates a number of carefully supervised rehearsals for all participating elements, both for naval forces and the raiding party. The employment of helicopters requires particular effort to familiarize pilots with the nature of the terrain to be traversed, with the employment of navigational aids, and with the details of the tactical plan.

d. Night Landing Techniques.--The following techniques assist in overcoming some of the difficulties of the helicopter and surface ship-to-shore movements in a night amphibious raid:

(1) Surface Landing

(a) Lucite wands, luminous tape, and luminous marking paint may be utilized to facilitate movement.

(b) Every means should be exploited in order to reduce the possibility of boats and amphibious vehicles becoming lost (e.g., they should not be required to serve shipping which is further away than vessels adjacent in formation).

(c) Transfer of personnel between ships during darkness is held to a minimum.

(d) Landing force reconnaissance units or underwater demolition units may be employed to plant radar, radio, or infrared buoys and beacons, or distinctive shielded lights on or off the landing beach. Lights of beacons should be of specified height, intensity, color, and if flashing, have a specified code. Use of steady white lights is avoided where practicable to avoid confusion with lights ashore.

(e) All personnel are given thorough training in the details of the ship-to-shore movement under conditions of reduced visibility with emphasis placed on the part individual members of the raiding party are to play.

(f) Dispatching and control of waves is facilitated by use of screened blinker light, electronic equipment, infrared equipment, voice radio, or loudspeaker. The method prescribed depends upon security requirements at the objective and conditions of visibility.

(g) If the colored light system is used for dispatching waves, it may be paralleled by infrared equipment, voice radio, and loudspeaker systems.

(h) Guide ships having the necessary radar equipment may be employed to lead the boat groups from the rendezvous areas to the line of departure.

(i) Each wave guide boat should be equipped with a radar reflector or radar beacon to permit accurate tracking by control ships.

(j) Control boats and ships should be equipped with sufficient infrared equipment to permit control activities to proceed simultaneously with intership signalling.

(k) Approach control points should be established at intervals in the boat lanes.

(l) The line of departure should be established as close to the beach as possible in light of hydrographic and tactical considerations.

(m) If other conditions permit, the course from the ship marking the approach lane to the line of departure should be the same as that for the line of departure to the beach.

(n) Coxswains and amphibious vehicle operators should be furnished with a chart showing locations of, and magnetic courses to, the control vessels and transports. Before the operation, special provision must be made to ensure that the amphibious vehicles are equipped with compasses. If none are so equipped, wave guide boats must be used until close inshore. Landing formation will either be a column or wedge.

(o) If the state of individual and unit training permits, consideration should be given to a high speed, underway launch of amphibious vehicles. For details, see FMFM 9-2, Amphibious Vehicles.

(2) Helicopterborne Landing

(a) The raiding party is moved to designated landing zones in a single lift.

(b) Control and navigational problems are reduced by selection of landmarks which are easily recognizable at night.

(c) Consideration is given to use of parachute or helicopter-landed pathfinders equipped with both radar and visual homing and landing devices.

(d) Approach and retirement lanes are well separated and should involve as few directional changes as possible.

(e) In the landing zones, egress routes and areas are identified with fluorescent tape or markers.

1127. SUMMARY OF AMPHIBIOUS RAID TECHNIQUES

To expedite the preparation of plans within the amphibious raiding force, the commander designated in the initiating directive assembles his staff in a central locality for coordinated planning. One of their first considerations is the acquisition and processing of available information, and the initiation of requests and directives for the collection of further information to support the raid. Concurrently, security and counterintelligence plans are established to prevent any disclosures of operations to the enemy. The raiding force commander's concept of operations ashore is the crux of the operation. Its development precedes detailed planning for surface and air support elements.

a. Preparation of Plans.--Preliminary organization of the raiding force, the selection of required personnel, and a tentative training program based on the concept of operations are formulated once the plan has tentative approval. Similarity to the objective area and isolation of the force are principal considerations in selection of the training and rehearsal sites. Constant examination by the commander and staff of all training and rehearsals provides a basis for evaluation and modification of plans. During this period, logistic requirements are determined and equipment procured to support the specific mission of the raid. In addition, equipment and supplies are packaged to be compatible with hatches and doors of the transporting aircraft or shipping and to meet any other specific requirements. The raiding force trains with the prescribed loads to test the feasibility of all equipment.

b. Embarkation.--Normally, the raiding force trains with the aircraft and/or ships to be employed in the actual raid. However, if the raiding force trains in a rear area and moves into a forward area to pick up their transportation, liaison and final rehearsals are conducted with the actual vessels to be employed. Prior to final embarkation, all personnel and equipment are checked against lists for embarkation. Nuclear and nonnuclear demolitions sets require separate stowage considerations. Other special stowage is arranged when required.

c. Movement to the Objective.--Final movement to the objective area normally is effected by stealth and deception. To avoid deterioration of proficiency attained in training, frequent drills and rehearsals are conducted. The training depends on the time available and type of transportation employed. In addition, daily inspections of equipment for serviceability are held. If possible, supplies are prepositioned for debarkation. Final and detailed briefing is held for all personnel. This briefing includes the latest intelligence on the objective area.

d. Ship-to-Shore Movement.--Once in the objective area, strict precautions are taken to avoid detection by visual, sonic, and electromagnetic detection devices employed by the enemy. Debarkation is conducted following established procedures practiced during training. Troops condition night vision below deck as debarkation may easily take twice as long when eyes are not accustomed to the dark. During debarkation, special precautions are taken for loading weapons and handling explosives. Just prior to going to debarkation stations, the transporting vessel issues to the raiding force the final heading from the ship to the landing beach, weather forecast, water temperature, estimate of set and drift of currents, wind conditions, and surf forecast.

(1) Once embarked in landing craft, a final check of equipment is conducted.

(2) Ship-to-shore navigation is conducted by dead reckoning, and the course is maintained by observation of celestial bodies, reference to shoreline silhouette, or prearranged signals from shore. Radars, when available, can be of considerable assistance. The course is set to compensate for set and drift of current and wind conditions.

(3) Reconnaissance/security and covering elements are the first to land, followed quickly by the main body. Prolonged station-keeping operations offshore are difficult and increase the possibility of detection. Beaching follows in rapid succession. Landing craft are either cached

ashore or returned to the ship. Parachute and SCUBA equipment are hidden if they are employed for entry. If boats are cached ashore, the raiding force must return to the same beach.

e. Approach to the Raid Objective.--Once the raiding force is ashore and has located its initial point in the vicinity of the landing beach, the various elements deploy to carry out their missions. While the covering element(s) provides security for the assault elements' movement to the objective, the assault element does not delay or wait for security. Enemy discovery of a covering element may alert the objective and thus successfully block the assault element from carrying out its mission. The raiding force avoids indigenous personnel unless specifically required by the assigned mission. Primarily because of security considerations, friendly guerrilla units are employed only to a limited degree.

f. Assault of the Raid Objective.--The attack on the objective is normally sudden and violent; however it may be accomplished by stealth (e.g., the objective is destroyed by delayed atomic or conventional demolitions after the raiding force has withdrawn). In most cases, missions requiring the destruction of an objective are easier than missions requiring the evacuation of prisoners or friendly personnel. When the force is assigned a destruction mission, a decision is made as to whether the whole objective is to be destroyed or just the components or personnel which are essential to its functioning. In many instances, the mission of the raid is the selective destruction of vital components of equipment or the killing of key enemy personnel. When supporting arms are employed, they normally commence with the assault of the objective and continue through the final withdrawal.

g. Retirement to the Beach.--The retirement to the beach is influenced by the time it takes to attack and assault the objective, enemy reaction, time needed to care for and evacuate casualties, and the mode of transportation used. In any case, it must be swift and orderly. Again, the covering element assists the assault element. Every effort is made to leave no evidence of the raiding force for enemy intelligence. However, when equipment cannot be reembarked, it is destroyed. Destruction techniques for all types of equipment employed by the raiding party should be made a part of individual and unit training. The evacuation of casualties is expedited by helicopters.

h. Reembarkation.--Once the raiding force arrives at the beach or landing zone, the means for evacuation seaward must be available for immediate loading. This is a critical coordination point in the withdrawal of the raiding force. In addition, the possibility of being discovered during the shore-to-ship movement is greater than during the ship-to-shore movement because the enemy is alerted and looking for the raiding force. Therefore, greater cover and protection are provided to prevent enemy interference with this overwater movement. Upon arrival alongside the transporting vessel, the raiding force, assisted by naval personnel, carries out procedures for reembarkation. In most cases, the ship is in an underway status prior to completing reembarkation. Once the report is made that the reembarkation is complete, the vessel leaves the objective area. When helicopters and/or aircraft are employed, the transport ship may proceed from the objective area as reembarkation takes place.

i. Recovery of Personnel.--A combination of recovery methods is usually better than reliance on any single method. In the event all

personnel are not initially recovered, alternate pickup locations, methods, and times are predesignated in the raid plan. Normally, recovery is attempted at 24-hour intervals for as many days as are practical without endangering the whole force. Personnel are briefed as to evasion, escape, and survival procedures beforehand and may have to depend on these skills to return to friendly areas.

(1) Immediately upon recovery, personnel of the raiding force are interrogated and debriefed by an intelligence officer or preferably by members of the planning staff. In addition, they are briefed as to what information may be released about the overall operation.

(2) After a suitable recovery period, the raiding force may be assigned a further raiding mission or it may enter into a retraining cycle.

Section II. AMPHIBIOUS DEMONSTRATION

1201. GENERAL

The amphibious demonstration is an amphibious operation employed for either strategic or tactical deception. It is planned and executed in accordance with the procedures delineated in LFM 01, Doctrine for Amphibious Operations, and LFM 02, Doctrine for Landing Forces. An amphibious demonstration may be conducted inside or outside the objective area, either by independent forces or by elements assigned to the commander amphibious task force. Amphibious demonstrations are executed in support of the main assault or as an independent operation. They may be conducted prior to, concurrent with, or subsequent to the main assault.

a. Definition.--In an amphibious operation, the demonstration is an exhibition of force which may be a feint or a minor attack. Normally, the amphibious demonstration is a diversionary feint at landing. It involves an approach to a beach or landing zone and terminates with the turning away of landing craft or helicopters prior to landing. The purely naval demonstration in which landing craft or helicopters are not launched is not discussed in this manual. Such a show of force is of interest to the commander landing force when it is executed to influence the deployment of enemy forces ashore.

b. Raids and Subsidiary Landings.--The commander amphibious task force may decide to employ an amphibious raid for diversionary purposes. In addition, subsidiary landings in support of the main assault where troops are established on the hostile shore or offshore islands may be conducted for these same purposes.

c. Degree of Risk.--A demonstration presents a degree of calculated risk to the main landing. This degree of risk is evaluated and accepted when plans for the demonstration and the main attack are made. The demonstration is designed to enhance the success of the main landing. Its failure should not place the landing force in jeopardy. The commander landing force is particularly interested in the evaluation of the results of the demonstration to determine its precise effect on the main landing.

d. Landing Force Participation.--Normally, there is a limited participation by a landing force in the execution of a demonstration. However, the commander landing force is active in its planning to ensure that proper support of the main attack is achieved. He is vitally concerned with the role landing force units play in the demonstration and the effect that their participation in the demonstration has upon their availability and readiness for the main assault.

1202. TACTICAL AND STRATEGIC DEMONSTRATIONS

An amphibious landing may be opposed by enemy forces already in the objective area, by forces which can move to the objective area, or by both. Demonstrations are staged to divert or immobilize hostile forces and may be categorized as either tactical or strategic.

a. Tactical Demonstration.--A tactical demonstration is conducted to influence the use of enemy forces in the objective area. It is of

direct concern to the amphibious task force making the main effort. The results of such demonstrations are almost immediate. The amphibious task force usually provides part or all of the demonstration force.

b. Strategic Demonstration.--When the enemy is capable of reinforcing defenses in the objective area with air, naval, or airborne forces, his attention may be distracted by conducting a demonstration hundreds of miles away. Such a demonstration is a strategic demonstration. Normally, units in the task organization making the main landing do not participate in a strategic demonstration. When enemy strategic reserve forces can exert a decisive influence on an amphibious assault, a strategic demonstration to divert or immobilize such reserves may enhance the opportunities for success of the amphibious task force making the main effort.

1203. PURPOSES OF THE AMPHIBIOUS DEMONSTRATION

An amphibious demonstration is conducted to distract, unnerve, or confuse the enemy by a show of force. It is designed to cause the enemy to revise his estimate of the amphibious task force's intentions and capabilities, to adopt an unfavorable course of action, or delay the adoption of a favorable course. Several specific effects may be sought.

a. Deception.--An amphibious demonstration seeks to deceive the enemy as to the time, place, and strength of the main attack. Such a demonstration attempts to achieve a high degree of realism and may include preparatory and supporting fires. It may provide for active counterintelligence actions such as the intentional disclosure of information of operations not intended for execution.

b. Improper Employment of the Enemy Reserve.--An enemy force may defend a coastal area by deploying its combat elements on the beaches, on terrain features dominating probable landing areas, and in depth as a mobile reserve. The mission of such a reserve may be to counterattack landing force elements. If the enemy reserve force is at some distance from the potential landing beaches or zones, it may fail to react to the initial landing area in time. A demonstration force properly employed may contribute to such failure. A realistic demonstration conducted some distance from the actual landing area may cause the improper employment of the enemy reserve, or a decisive part of it. Such a demonstration may be made at the same time as an actual landing so that the enemy forces in a single, central location are confronted with what appears to be two separate landings. In such a situation, the enemy may be unable to decide which area is the site of the main effort and delay committing his reserves until it is too late. Such a demonstration may also be conducted subsequent to the main assault to accomplish similar results.

c. Attract Enemy Supporting Fires.--When enemy supporting fires are diverted from the main assault, the chances for success of the main landing are materially increased; i.e., enemy aircraft, naval gunfire, and artillery employed elsewhere cannot be used against the main landing. Demonstrations for this purpose may be executed inside or outside the objective area and are normally conducted concurrently with the main landing. The demonstration inside the objective area is conducted within the range of weapons which can deliver fire on the main beaches and is designed to induce the enemy to move his supporting weapons or to distribute his fires between the two forces. The demonstration outside the objective area is designed to cause the enemy to deploy naval and air forces away from the objective area

where they will be unable to interfere with the actual landing. Enemy reserves employed elsewhere cannot use their weapons against the main landing.

d. Distract Attention From Preliminary Operations.--When it is necessary for personnel to perform missions ashore or close inshore prior to the main landing, it is desirable to distract hostile attention from these areas. This is especially important because rèconnaissance patrols, underwater demolition teams, and other units with similar missions are normally unable to protect themselves and still perform their mission. Demonstrations for this purpose are conducted away from the area where the clandestine operations are being conducted. However, they are conducted near enough so that the enemy in the main landing area physically moves to the demonstration area or diverts his attention to it.

e. Cause Premature Opening of Fires.--A properly conceived demonstration may cause the enemy to open defensive fires prior to the actual landing. The purpose of such a demonstration is to cause the enemy to waste ammunition and reveal the location of large caliber weapons. In an amphibious operation, preliminary bombardment is directed at enemy installations which have been discovered by reconnaissance. However, there are always some weapons that escape detection. Frequently, there are weapons which are considered destroyed when, in fact, they are operable. A demonstration may induce the enemy to fire these weapons and reveal their positions. Such weapons can then be brought under fire. This type of demonstration is conducted in the actual area where the landing is to be made. Enemy weapons are provoked into firing by making a realistic demonstration at any beach or landing zone within range.

f. Place an Early Burden on Enemy Communications.--The failure or overloading of the enemy's communication channels may reduce the effectiveness of his defense. A series of demonstrations conducted at a crucial time can overload or severely tax hostile communication facilities. He may delay deployment of enemy reserves or transmission of important orders and intelligence.

g. Precipitate a General Air or Naval Engagement.--When enemy air and naval strength jeopardizes the success of an amphibious operation, a demonstration may lure the enemy into a general engagement. The primary purpose of such a demonstration is to reduce the enemy's air and naval forces.

h. Harassment.--When forces and time are available, an enemy in a coastal area may be so harassed by repeated threats of landings and air and naval attacks that he becomes weakened, exasperated, and careless. He may become so conditioned to threats which result in no action that, when the main attack comes, he will fail to take swift and aggressive action compatible with his overall combat capabilities.

1204. LOCATION OF AMPHIBIOUS DEMONSTRATIONS

a. Demonstrations Outside an Objective Area.--An amphibious demonstration may be conducted outside the objective area by independent amphibious task forces, on order of higher authority, to support military plans and policies of a strategic nature or to support an amphibious assault. When in support of an amphibious assault, the time and place of the demonstration are designated based on the recommendations of the commander

amphibious task force. Demonstrations conducted outside the objective area are designed to divert and immobilize enemy strategic reserves or other forces capable of affecting the landing, to distract hostile attention from such an operation, to precipitate a general air or naval engagement, or to harass the enemy.

b. Demonstrations Within the Objective Area.--An amphibious demonstration is conducted within the objective area when its intention is to directly influence the enemy's reaction to an assault landing. Such a demonstration is designed to cause the enemy to employ his reserves improperly, to disclose weapon positions by inducing him to fire prematurely, to distract his attention, to place an early burden on his communication system, to precipitate a general air and naval engagement, or to harass him. The decision to conduct a demonstration within the objective area is made during planning by the commander amphibious task force in consultation with the commander landing force. Such consultation is extremely important even when landing force elements are not employed in the demonstration because of the influence which a demonstration can exert on the landing force's scheme of maneuver.

1205. COMMAND RELATIONSHIPS

Command relationships for an amphibious demonstration are delineated in the ATF order and, in general, conform to LFM 01, Doctrine for Amphibious Operations.

a. Demonstrations outside the objective area are initiated by the commander of a unified, specified, or higher command. Normally, an independent amphibious task force conducts these operations.

b. Demonstrations performed within the objective area are normally placed under a subordinate naval commander who has a parallel landing group commander. This command is terminated by the commander amphibious task force upon completion of the mission and the procedures for termination of this responsibility are set forth in his order. Assistance during the planning and execution of the demonstration is provided the naval demonstration group commander by his parallel landing group commander. Close staff coordination between the appropriate naval commander and landing group elements materially assists in the execution of a realistic and effective demonstration.

c. The demonstration is usually designed to deceive hostile forces ashore. It will thus have a direct effect on the landing force concept of operations and will probably require the participation of a portion of the landing force. The recommendations of the commander landing force should therefore be a major factor in planning the demonstration.

1206. TASK ORGANIZATION

a. General.--The task organization of an amphibious demonstration force is based on consideration of the following factors:

(1) A demonstration force should be large enough to convince the enemy that it is a complete amphibious task force. A force which fails to give such an impression has no effect but to divert ATF ships and troops from areas where they may be more profitably employed.

(2) A demonstration force should be large enough to cause the enemy commander to take the desired action; e.g., shipping which carries only a BLT cannot be expected to influence the enemy's reserve division.

(3) A demonstration force should be constituted for realism from outward appearance. No matter how large a demonstration force may be, if it is not composed of ships typical of an amphibious task force, it is unlikely to deceive the enemy except at night. When the ship-to-shore movement phase of an amphibious demonstration can be observed, troops are necessary for realism. Even when naval maneuvers appear authentic, if no troops or if an insignificant number are moving from transports into landing craft or helicopters, the enemy will not be deceived. The same holds true for equipment. If no ships suitable for landing tanks are present, enemy antitank forces cannot be expected to react.

b. Components.--A demonstration group is a component of the amphibious task force organized to conduct operations intended to deceive the enemy. It may include embarked landing group units and any or all of the following components required for execution of its mission:

(1) Tactical air control.

(2) Fire support.

(3) Attack carrier.

(4) Screening.

(5) Mine warfare.

(6) Reconnaissance and underwater demolition.

(7) Tactical deception.

(8) Close covering.

(9) Transport.

c. Advance Force.--An advance force may be used as a demonstration force. An advance force is normally composed of all types of ships except transports, cargo ships, and landing ships. The addition of these ships gives the advance force the appearance of an amphibious task force. When so constituted, it can conduct demonstrations. However, an advance force should not be required to neglect its primary mission. Sometimes, when not assigned a demonstration mission, an advance force may be required to support and cover a specially constituted demonstration force.

d. Screening Group and/or Close Covering Group.--A force acting as a screening group or covering group during the earlier stages of an overseas movement may, when nearing the objective, become a demonstration force. Such a force requires augmentation similar to that required for an advance force and operates with similar regard for its primary mission. It normally conducts a demonstration in an area in the vicinity of the actual landing so that it can continue in, or quickly revert to, its primary role.

e. Transport Group.--A demonstration can be conducted after commencement of the actual landing by a force composed primarily of empty

transport ships. To succeed in such a ruse, it is necessary that the demonstration be conducted at a time and place which prevent the enemy from realizing that transports and landing craft are unloaded.

f. Independent ATF.--While one amphibious task force is conducting an operation, another ATF en route to a different objective may execute a supporting demonstration after which it proceeds to its assigned objective area.

g. Landing Force Elements.--The landing force reserve may be available for employment in demonstrations to support the main landing. Also available for this purpose are troops such as combat service support units and base development and garrison force units which are not designated to land until tactical units are firmly established ashore. Various other elements organic to the landing force can provide support and visual, sonic, and electronic tactical deception to the demonstration. In addition to helicopters, landing force aviation provides an important fire support element for the execution of an amphibious demonstration.

(1) Landing Force Reserve.--A demonstration may consist of reserve units of the landing force and the ships transporting them. Tactical elements of the landing force reserve are probably the best nucleus from the standpoint of effectiveness. The transports are loaded with troops and have landing craft aboard. In addition, troops and ships' personnel are trained to execute the ship-to-shore movement. There are, however, certain dangers in using the reserve.

(a) When the demonstration is being conducted, the reserve is not immediately available to the commander landing force. It may be absent at a time when it could be more effectively employed or is urgently needed. A demonstration requires much merit before the ready availability of the reserve is sacrificed to make it possible.

(b) A demonstration employing the landing force reserve is considered from the tactical viewpoint, unless it is conducted sometime before the actual landing. The reserve is not normally allowed to get so far away that it cannot be recalled quickly. For this reason, the demonstration which holds the most promise of success sometimes gives way to one which is more practical.

(c) A demonstration force employing the landing force reserve normally uses amphibious task force fire support ships. Supporting fires available for the actual landing are therefore reduced.

(2) Helicopters.--Helicopters are suited for demonstrations. The speed with which they can approach and withdraw from potential landing zones presents a critical problem of decision to the enemy defense force commander. He must decide in an extremely brief period of time either to commit or withhold his defensive forces. Demonstrations in several potential landing zones conducted simultaneously with an actual landing may result in complete confusion of the enemy and result in his withholding forces from decisive areas.

1207. PLANNING AND EXECUTION

Amphibious demonstrations are planned in the same general manner as an amphibious assault. (See LFM 01, Doctrine for Amphibious Operations;

LFM 02, Doctrine for Landing Forces; and FMFM 3-1, Command and Staff Action.) In planning an amphibious demonstration, the various amphibious planning phases are abridged to fit the purpose and type of the specific demonstration to be conducted. Planning is principally concerned with providing realism. To overplay or underplay a demonstration destroys its effect. It is important that the enemy receive a convincing impression of preparations for a landing. Plans ensure that all visible, audible, and electronic aspects of the demonstration appear authentic. The demonstration plan provides for the approach of the demonstration group to the demonstration area, the ship-to-shore movement, the employment of supporting fires, reembarkation, withdrawal, and dispersal of the demonstration group. Normally, a communication deception plan is used. On occasion, underwater demolition teams add realism. Tactical deception units can contribute to the deception. Demonstration plans require considerable flexibility to ensure that the demonstration is prolonged for a sufficient period of time to allow the enemy to react to it. Principal among the factors considered in developing demonstration plans are:

a. Intelligence Requirements.--An effective demonstration plan requires accurate and complete intelligence. The commander charged with development of the demonstration plan requires a carefully prepared intelligence estimate. In addition, measures are undertaken to counter enemy intelligence collecting activities. Such measures are particularly concerned with preventing disclosure of the special nature of the projected operation. A demonstration planned and executed on fragmentary or inaccurate intelligence and without active counterintelligence measures may make the operation more difficult rather than easier.

(1) Intelligence planning factors associated with amphibious demonstrations can present vital and unique requirements. In addition to the development of intelligence to support the amphibious demonstration when extraction is planned, the intelligence planning requirements may be expanded to include preassault collection of information on:

(a) Withdrawal exits.

(b) Postassault tidal data.

(c) Enemy response to use of radio-frequency (RF) communication dummies.

(d) Enemy response probabilities to use of stay-behind dummy equipment and positions ashore.

(e) The area that the enemy will believe to be the objective of the amphibious assault.

(2) Amphibious demonstrations used for tactical deception can be part of an operational cover plan including several forms of deception. Cover plans are controlled by the senior operational commander in the area of the "covered" activity or deception. Effective operational cover plans can include several independent or supporting forms of deception.

(3) Counterintellingence requirements in support of an amphibious demonstration are more complex and difficult than counterintelligence operations in actual assaults. Not only must the commander protect the planning, embarkation, and movement to objective areas from enemy detection,

but the commander must, at the time intended for the enemy to discover our activity, encourage the enemy's interest, if necessary. Further, such interest must be limited to those manifestations of our operational conduct, afloat or ashore, that we desire to have him know.

b. Selection of the Demonstration Area.--An amphibious demonstration may be conducted in the actual landing area or an area outside it. In arriving at a final decision in this matter, the commander and his staff consider the following factors:

(1) Within the Landing Area.--In certain situations, a demonstration is staged off the beach or beaches where the actual landing is to take place.

(a) A demonstration intended to cause the enemy to open fire prematurely takes place in the landing area. The enemy is provoked into opening fires with weapons whose positions he would prefer to conceal. After such weapons are located, preparatory fires are resumed.

(b) When the purpose of the demonstration is to harass and exhaust the defender, it normally takes place in the general area of the proposed landing. However, to avoid indicating the exact location of the actual landing, simultaneous demonstrations may be conducted in a similar manner at other locations.

(c) When the purpose of the demonstration is to precipitate a premature commitment of enemy air or naval strength in an area where there is only one satisfactory landing beach, a demonstration is conducted there. If it is made elsewhere, the enemy may recognize it as a deception and avoid committing his strength.

(2) Outside the Landing Area.--Most demonstrations are conducted off beaches other than those on which the actual landing is made. Their primary objective is to influence the employment of the enemy's reserves. Frequently, the demonstration beach is one which was given serious consideration as the actual landing beach during the planning phase. It may still be a landing area included in an alternate plan. For these reasons, the extensive reconnaissance usually required is normally available.

(3) Nature of the Area.--To provide for realism, a demonstration beach should be adequate for the force to make an actual landing. If the hydrography is such that a landing in force is clearly impossible, it is not likely to deceive the enemy. A demonstration conducted seaward of an unsuitable landing area has little chance for success. When beach conditions afford an opportunity to land but routes of egress are difficult, the enemy may elect to wait until the force is well established before acting. Since troops do not go ashore in a diversionary feint at landing, enemy reserves will not normally move in such a case.

(a) The area selected for the demonstration should be important to the enemy. He is unlikely to move forces to counter an attack in an area which is of little or no value to him.

(b) When the landing force reserve is employed as part of the demonstration force, the demonstration beach should be near enough to the actual landing beach for the reserve to be available when needed.

(c) The demonstration beach for a demonstration conducted simultaneously with the actual landing should be far enough from the actual landing beach or beaches so that:

1 A high yield explosion will not affect both forces.

2 The actual landing and demonstration forces do not interfere with each other's operations. Two separate naval forces require a large amount of sea room. Their transport and fire support areas should not overlap. Both forces need room to maneuver and take evasive action.

3 Preferably, the demonstration area should be far enough removed so that enemy weapons emplaced or sighted to cover the actual landing site have to move in order to fire on the demonstration. On occasion, the aim may be to prevent the enemy massing all of his available fires on the actual landing. In the latter case, the demonstration area is within range of the enemy weapon in the actual landing area.

c. Selection of the Time for the Demonstration.--The time for staging a demonstration depends on the effect desired and the enemy situation. It may be staged before, during, or after the actual landing.

(1) Before the Landing.--A demonstration is conducted before the main landing when it is intended to lure the enemy forces away from the proposed landing area, or to prevent enemy forces from moving into it. The timing of such a demonstration depends on the distance it is hoped the enemy is to be moved and the beginning of advance force operations. An effective demonstration should cause the enemy to move his reserves far enough to delay them long enough that they cannot be used against the actual landing. Enemy delay can sometimes be increased by prolonging the demonstration. It should be noted that when the enemy has no reason to anticipate an amphibious assault, a demonstration before the actual landing may do more harm than good. Therefore, a commander always considers whether the advantage to be gained outweighs the advantage of surprise. Demonstrations normally staged before the actual landing include those designed to:

(a) Cause the enemy to disclose his defensive positions.

(b) Harass and exhaust the enemy.

(c) Distract attention from other preliminary operations.

(d) Precipitate a premature commitment of enemy air and/or naval forces.

(2) During the Landing.--A demonstration which is intended to have a local effect is conducted simultaneously with the actual landing. Such demonstrations are designed to cause the enemy to employ his reserve and fire support improperly. When enemy reserves are on the coastline between the demonstration and actual landing areas, a demonstration conducted at the same time as the actual landing may serve to immobilize them temporarily.

(3) After the Landing.--A demonstration may be conducted after the actual landing to distract enemy fire from the landing area. When these fires are delivered by permanently emplaced weapons, the demonstration area

must be within range. Displaceable enemy weapons must be made to displace to new or alternate positions from which they can take the demonstration area under fire. Post-landing demonstrations should be executed in an area which the enemy believes to be critical, if he is to be persuaded to divert fires from an assault already in progress.

(a) A demonstration conducted after the actual assault may be staged to prevent or delay the enemy from committing his reserves against forces already ashore.

(b) If the amphibious campaign is conducted against a large land mass, it is possible to conduct a series of post-landing demonstrations along a broad coastal area. These can serve to maintain or increase the effects obtained by earlier demonstrations and to keep the enemy off balance.

d. Supporting Arms.--The demonstration plan provides for air and naval gunfire support in sufficient quantity to simulate an actual amphibious landing and to prevent loss of deception. This includes sufficient pre-D-day preparation fires. Demonstration beaches require as much preparatory fires as actual landing beaches. Support is planned to continue throughout the demonstration and to cover the withdrawal of the demonstration force. Air and naval gunfire support plans are as complete and detailed as those for the actual landing. For detailed information regarding the preparation of such plans, see FMFM 5-1, Marine Aviation; FMFM 7-1, Fire Support Coordination; and FMFM 7-2, Naval Gunfire Support. Plans normally provide for using the same aircraft groups for both the actual landing and demonstration forces. Ships supporting the demonstration force may frequently deliver deep supporting fires for the actual landing, especially if the two efforts are conducted in vicinity of each other; e.g., on the opposite sides of an island or peninsula.

e. Rehearsals.--Plans provide for sufficient rehearsals to ensure that the demonstration will be realistic. A force which sailed directly to the objective without the customary rehearsals would probably be regarded with suspicion.

f. Realism.--In the execution of the demonstration, unnecessary and/or obvious striving for effect may be fatal. A move is never repeated on the assumption that the enemy did not see it the first time. It is certain that once the presence of the amphibious demonstration force is discovered, its every move will be scrutinized in minute detail. No step or phase customary in the actual landing is omitted. There can be no lack of smartness in ship or boat handling and no lethargy on the part of the troops. The approach of helicopters should be conducted realistically and provide for such deception as underslinging and dropping dummy cargo.

g. Personnel Economies.--An enemy observer at a distance cannot determine whether troops are going up or down a cargo net. Consequently, economy in the use of personnel is possible. The same troops can go up and down. The appearance of great activity is realistic and the same men can be used repeatedly. In addition, since only a few men are in boats when they leave ships, few men are exposed to the hazard of enemy defensive fires. Similarly, activities of heliteams enplaning on flight decks of assault helicopter aircraft carriers and amphibious assault ships can be accomplished with fewer personnel. Helicopters may even make demonstration flights without troops on board.

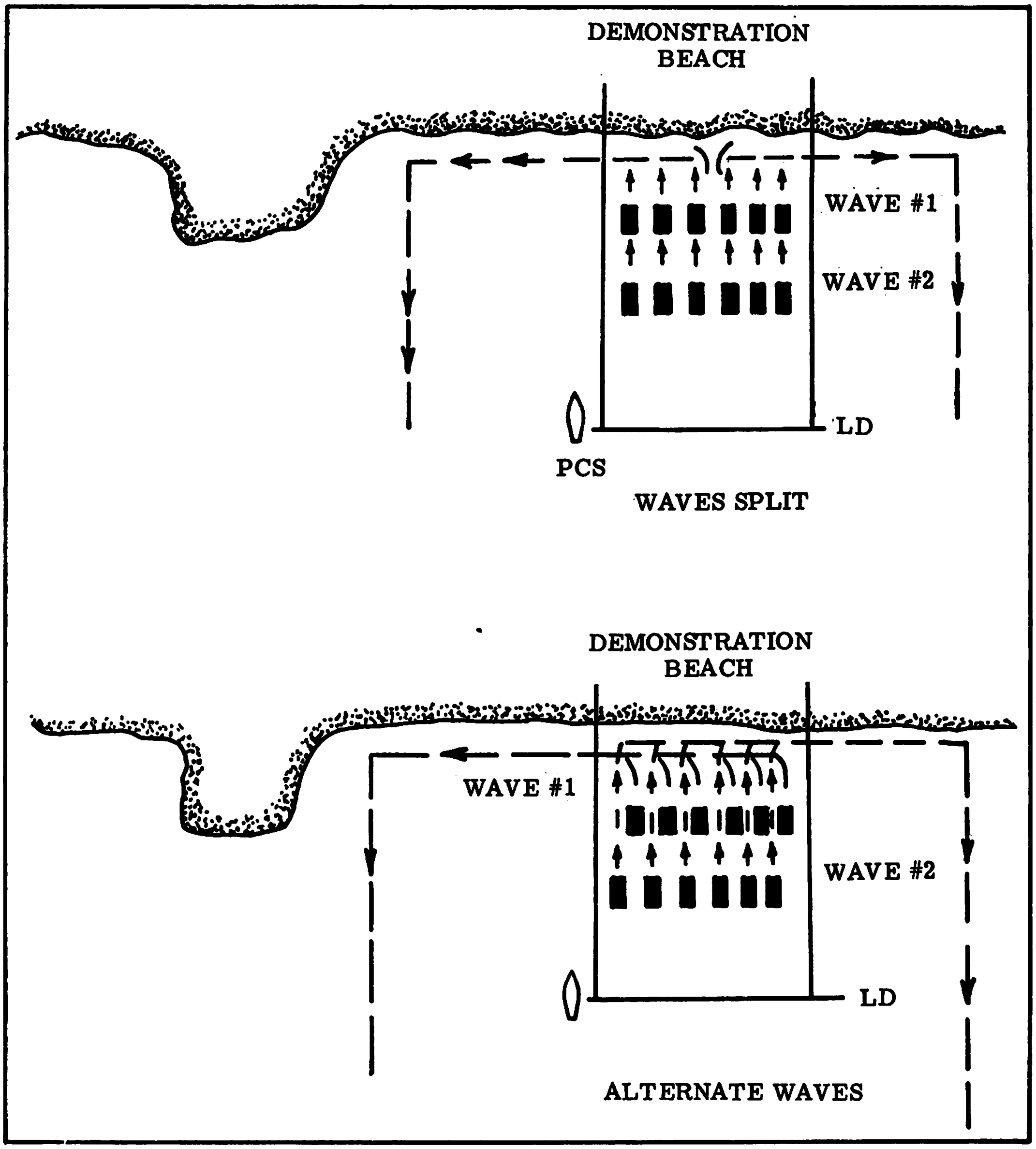

Figure 4.--Turnaway at Beach.

h. Ship-to-Shore Movement.--Except for the actual landing which is eliminated, the ship-to-shore movement in a diversionary feint at landing is executed in the same manner as in an actual landing. The same plans, diagrams, tables, and schedules are required.

(1) Waterborne.--Landing craft moving toward the beach reverse or change their course when the leading wave reaches a line as close to shore as hydrography or enemy fire permits. (See fig. 4.) Turning away from the beach is executed either at a scheduled time or on signal. When

the time of turn is influenced primarily by hydrographic considerations, the turn is normally made at a specified time. If enemy fire is expected to influence the time of turning, it is normally made on signal. An approach made under conditions of low visibility is generally reversed at a predetermined time. In any case, exceptionally good control by wave commanders and guides is mandatory. It is desirable that the leading wave not turn until it comes under enemy fire. If the enemy observes that the leading wave turns after it has been fired upon, he is likely to assume that he has repulsed the landing. He may not know that there has been a demonstration even after the feint is over. The effect of the demonstration can be continued if the enemy expects that another attempt at landing may be made. On the other hand, a demonstration force that turns away from the beach before being fired on may reveal itself for what it actually is.

(2) Helicopterborne.--Helicopter demonstrations are extremely rare. Generally, prelanding and H-hour demonstrations are precluded because there are not enough helicopters to satisfy overall requirements for the actual landing and a demonstration. When helicopters can be employed, set procedures for withdrawal are necessary. Upon arrival over the landing site, withdrawal is made on radio command of the flight leader. It is given at the discretion of the flight leader on receipt of ground fire even if the flight has not reached the simulated landing site. The selection during planning of approach and retirement lanes and simulated landing sites is based on intelligence reports that these areas are relatively free of enemy activity. Landing sites are in defilade where enemy observation is limited and where it will be difficult for the enemy to determine if helicopters have landed and troops have deplaned.

1208. NIGHT DEMONSTRATIONS

Night demonstrations are subject to many of the same difficulties of night landings. There are some ways, however, in which darkness and other conditions of low visibility can aid the conduct of demonstrations. In some instances, enemy overdependence on electronic devices at night may make it possible to deceive him.

a. Advantages of Night Demonstrations

(1) Economy of Force.--A night demonstration may provide for economy in the use of ships and troops. While a demonstration force clearly visible during daylight must appear as a well balanced force, a night demonstration force need not be so well balanced. An adequate number of ships of approximately the right size may be sufficient inasmuch as ship types cannot be determined from radar scope presentations. Thus, a force of miscellaneous ships can simulate an attacking force when visibility is poor. However, a force of this type is faced with a special problem. It may be observed by enemy long-range patrol aircraft when approaching the objective area. To avoid having its true nature discovered, such a force makes all the voyage within the range of patrol aircraft under conditions of low visibility. Another possibility is for the demonstration force to break off from another force when close to the objective. During a diversionary feint at landing which is clearly observed by the enemy, realism requires that some fully equipped troops debark from transports into landing craft. During a night demonstration, troops are not required. However, landing craft remain alongside transports as long as it would ordinarily take troops to debark in darkness.

(2) Use of Electronic Countermeasures.--Since the enemy relies on radar equipment for information on the activities of a night demonstration force, devices designed to cause his radar equipment to emit false projections can be used effectively. His radar can be jammed to receive an intermittent and partial picture of the demonstration. If radar jamming is used where there is no particular activity to be concealed, enemy imaginations may provide the activity.

(3) A More Rapid Enemy Reaction May Occur.--The opportunity to move his weapons or reserve forces under cover of darkness may be seized upon by the enemy in the face of a night demonstration. A defense commander who might wait to consider carefully the development of a daylight demonstration may be induced to make a hasty decision and take advantage of the cover of darkness to move his weapons and reserves.

b. Effectiveness of Night Demonstration.--Because of reduced visibility and limited observation of enemy reaction to the night demonstration, planning should provide for the use of aerial sensor systems--side-looking airborne radar, infrared, and others--together with ground surveillance systems to determine the effectiveness of the demonstration.

1209. EVALUATION OF RESULTS

Commanders employing demonstrations cannot assume that they have had the desired effect. The device of the demonstration is not the exclusive property of the attacker. An enemy reaction to a demonstration may itself be a deception. Only in the most unusual circumstances should an operation be planned so that success of the main effort is contingent on a successful demonstration. The purpose of a demonstration is to reduce opposition encountered by the amphibious task force in the crucial early stages of its landing. The presence of a demonstration force does not permit a reduction in strength of the actual landing force. Assault elements require sufficient strength to succeed even if the demonstration fails. A demonstration may also have effects other than those anticipated. For example, if the mission of the landing force is to destroy enemy forces within a certain time, it may fail if a demonstration lures the enemy from the landing area into an area suitable for protracted resistance.

Section III. AMPHIBIOUS WITHDRAWALS

1301. GENERAL

An amphibious withdrawal is a withdrawal of forces by sea in naval ships, craft, helicopters, and/or aircraft from a hostile shore. It is planned and executed in accordance with the procedures for amphibious operations delineated in LFM 01, Doctrine for Amphibious Operations; LFM 02, Doctrine for Landing Forces; and FMFM 3-1, Command and Staff Action. The withdrawal may be forced or voluntary. The action which precedes the withdrawal is ordinarily a form of retrograde movement. Such a retrograde movement is conducted in accordance with doctrine and techniques delineated in FMFM 6-1, Marine Division, and FMFM 6-2, Marine Infantry Regiment. In exceptional cases, where enemy forces interpose themselves between the landing force and the sea, offensive action to seize a withdrawal area precedes the withdrawal. The amphibious withdrawal depends on the ability of the landing force to occupy and control a suitable withdrawal area and on the effectiveness of defensive measures taken to restrict enemy forces and fires in that area. The withdrawal ends after embarkation of the covering force elements of the force being withdrawn.

1302. PURPOSE OF THE AMPHIBIOUS WITHDRAWAL

The purpose of an amphibious withdrawal is to evacuate forces so as to preclude their loss and/or to employ them elsewhere.

1303. CHARACTERISTICS OF THE AMPHIBIOUS WITHDRAWAL

The amphibious withdrawal is similar to the amphibious assault, in that it depends upon the sea for support and transportation. Except in the case of the withdrawal associated with amphibious raids, the planning processes are normally abridged. Where enemy action against the landing force is substantial, or when the requirement for the forces elsewhere is great, the time available for execution is brief. Facilities for embarkation and loading usually are extremely restricted, and logistic problems are intensified. When the withdrawal is conducted in the face of strong enemy action, the requirements for security are of paramount importance. Requisite fire support means may not be available. Means for controlling the withdrawal may be limited. The operation may, of necessity, be conducted under adverse conditions of weather, terrain, and hydrography. Circumstances, at times, render it advisable to conduct the withdrawal under conditions of limited visibility. A successful withdrawal can be accomplished so long as the force involved maintains local air and naval superiority, keeps an offensive capability, and takes positive measures to reduce its vulnerability to enemy nuclear attacks. Knowledge of embarkation procedures and high morale are also important factors for success.

1304. ORGANIZATION AND COMMAND RELATIONSHIPS

The organization of forces, the responsibilities for accomplishment of tasks, and the command relationships during the amphibious withdrawal are essentially the same as those during the assault phase of an amphibious operation. (See fig. 5.) Such variations in responsibility and command authority as are required by the specific situation are announced in the directive initiating the operation. During execution, exchange of

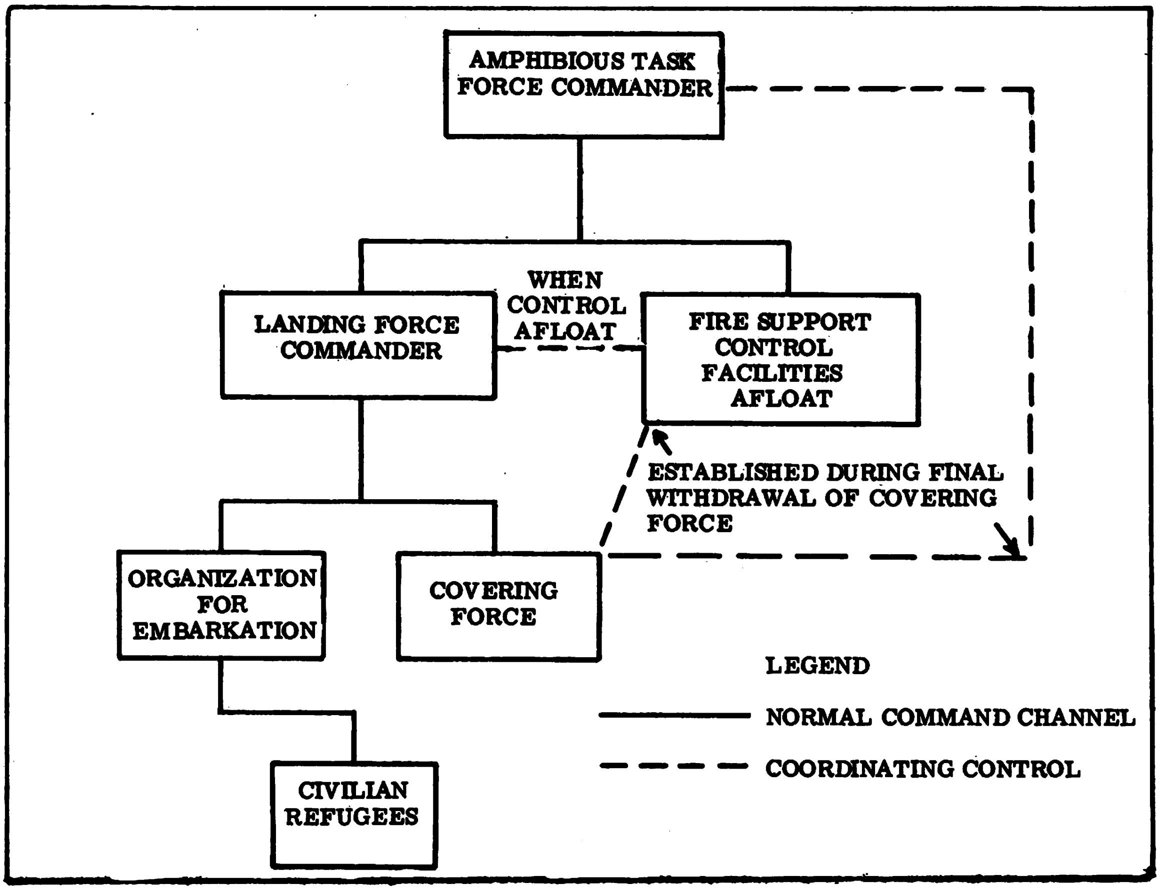

Figure 5.--Organization and Command Relationship During Amphibious Withdrawals.

responsibility is agreed upon by the commanders concerned and is approved by their next higher commanders.

a. Commander Amphibious Task Force.--Upon establishment of the initial defense of the embarkation area, control functions which were transferred ashore are phased back to control facilities afloat under the commander amphibious task force. In cases where the withdrawal is subsequent to the termination of an amphibious operation, these control facilities afloat are reestablished and are prepared to function upon establishment of the initial defense.

b. Commander Landing Force.--The commander landing force retains command of the landing force during the amphibious withdrawal. His relation to the commander amphibious task force is the same as that which exists during the amphibious assault.

c. Covering Force Commander.--The mission of the covering force commander is to prevent enemy interference with the withdrawal beginning with the initial defense until final embarkation of covering force elements. He is not responsible for the embarkation.

d. Embarkation Officer.--Combat cargo officers and embarkation officers assist their respective commanders in planning the embarkation and supervising its execution. Command decisions are made swiftly and the embarkation organization requires secure, reliable, and rapid communications between the naval forces and the landing forces. An important function of the embarkation organization is to ensure that adequate support is provided the covering forces during the embarkation. This may involve destroying excess equipment which cannot be embarked while at the same time unloading critical supplies from ships to support forces on the beach.

1305. INTELLIGENCE

Intelligence has an extremely important role in the withdrawal. As a result of not having the initiative, the landing force finds it more difficult for its intelligence agencies to operate. Sources of information are not as easily or frequently uncovered. The very nature of offensive operations provide a considerable measure of security, which is not present in the withdrawal. As a result, the G-2 gives special consideration to the collection plan and to the agencies that can be used. He exploits every source of information about the enemy in order that the landing force can be kept informed about the enemy.

a. During the period that landing force elements conduct delaying actions to cover the amphibious withdrawal, the G-2 is primarily concerned with providing information about the enemy: location, type, size, and activity. Such information, augmented by information from ground units and from other sources, is invaluable in keeping the commander landing force and subordinate commanders abreast of the situation. In addition to obtaining information about the enemy, intelligence collection agencies function in a target acquisition role. The capabilities of these units enable them to provide information forward of the delaying position, within the delaying position, and to the flanks and rear.

b. Equally important with acquiring information about the enemy is the necessity of denying the enemy information about landing force operations. A counterpart to intelligence planning is counterintelligence planning. The counterintelligence plan is devoted to reducing the effectiveness of hostile intelligence gathering agencies and preventing information concerning the landing force from aiding the enemy in his generation of combat power. Every effort is made to prevent the enemy reconnaissance agencies or elements from learning of the landing forces' location, strength, and dispositions. Hostile ground reconnaissance elements must be kept forward of the FEBA. Also, passive actions are required to minimize information that the enemy may gain by aerial means and surveillance devices.

c. Withdrawal operations can afford an opportunity for intelligence collection by "stay-behind" ground surveillance sensors. Emplacement in areas still within our physical control will be very accurate and can provide for target acquisitions in the amphibious withdrawal during both the execution and postwithdrawal phases.

1306. PLANNING

Planning for the amphibious withdrawal is centralized and as detailed as available time and resources permit. The sequence of planning is similar to that for a normal amphibious operation. The commander's decision and concept for the amphibious withdrawal essentially contain

the same elements. In addition, they include the manner of withdrawal, security during movement and time phasing, the occupation of subsequent position(s) to the rear, organization and security of the reembarkation area(s), and procedures for the embarkation of the landing force. In the development or refinement of plans for the amphibious withdrawal, the essential elements include provision for positive and effective coordination, complete control of routes of movement, control of civilian personnel, and means to ensure flexibility in the operation.

a. Withdrawal Plan/Order.--The withdrawal plan/order normally provides for the following:

(1) Date and time of withdrawal.

(2) Defense of the embarkation area.

(3) Organization for combat.

(4) Phasing of the withdrawal.

(5) Assignment and priorities of routes and zones of withdrawal and troop, cargo, and vehicle assembly areas.

(6) Covering forces.

(7) Deception and security.

(8) Delay between positions.

(9) Fire support.

(10) Employment of the reserve.

(11) Evacuation of casualties, supplies, and equipment.

(12) Traffic control.

(13) Shore-to-ship movement.

(14) Embarkation.

b. Alternate Plans.--In the development of the plan for the withdrawal, careful consideration is given to maximum flexibility. Essentially, the mission and contributing tasks are fixed. Alternate plans are developed to meet anticipated changes that may affect the principal plan. All aspects of the operation are analyzed to ensure that maximum freedom of action is given subordinate commanders under contingency situations.

c. Selection of the Embarkation Area.--The embarkation area and beaches are selected by the commander amphibious task force in consultation with the commander landing force. To achieve maximum speed in embarkation and to provide passive protection against nuclear weapons, multiple embarkation beaches within the embarkation area may be required. Other factors considered in selecting the location and number of embarkation beaches include hydrography, distance from transport area, availability of suitable assembly areas, proximity to the landing force as a whole and the covering force in particular, and protection from enemy observation and

fires. When all factors involved in the selection of the beaches or the area are more or less equal, terrain is a deciding factor in final selection. Terrain which has good observation and fields of fire for landing force elements and screens the embarkation areas from the enemy is desirable. Barrier and denial systems, of natural and manmade obstacles, including extensive minefields and demolitions, are exploited in combination with the terrain to minimize enemy interference. Cover and concealment are sought for assembly areas and routes to the embarkation beaches.

d. Organization for Combat.--Organization for combat is effected to ensure maximum flexibility and full utilization of resources consistent with the type operation and the mission to be executed. In cases where control and security of supporting elements cannot be effectively established, appropriate fragmentation and attachment is effected.

(1) To ensure responsiveness to provisions of the plan by all elements, appropriate arrangements are made for reconnaissance. Elements expected to perform supporting tasks in the operation are made as self-sufficient as possible consistent with the mission to be executed. Plans for providing support of operational elements of the landing force are integrated into the overall plan.

(2) The size of the covering force must be adequate to ensure that it can accomplish its mission. The strength and composition of the covering force varies in different sectors of the embarkation area. A unit occupying a sector protected by a formidable obstacle may require only minimum security elements, while a unit in open terrain may require reinforcement. Supporting troops are attached to the covering force as required. Early embarkation of heavy support weapons requires reconciliation with the conflicting requirement for such elements in support of the covering force. Reconnaissance troops, artillery, tanks, and engineer and medical personnel are included even with a minimum size covering force.

e. Control/Coordination.--To provide for the loss of contact and to ensure unity of effort in this situation, the plan of operation is made known to the lowest subordinate leaders, consistent with security. Concurrent with planning, liaison is established with adjacent elements to ensure mutual support, flank security, and provide unity of effort. In the event adjacent units do not employ forces in a manner to prevent envelopment of withdrawn forces, reserves are set aside for this purpose.

(1) Control measures employed in the withdrawal include initial points (IP's) and release points (RP's), guides, assembly areas, routes of withdrawal (including alternate routes), traffic control posts, and route priorities.

(2) Initial assembly areas are located well forward to facilitate early reorganization of the units for the withdrawal. Assembly areas are located on good routes of withdrawal, in defilade if possible, and with adequate turnaround space provided in or adjacent to them when transportation is used. Assembly areas for units withdrawing at night are planned, but may not be occupied when the commander senses that the movement can be controlled without their use. When used, they are occupied for the briefest possible period. The occupying unit provides its own security.

(3) Alternate routes are provided to ensure the orderly movement of the force to the withdrawal area in the event that primary routes are blocked.

(4) Assembly areas in the withdrawal area should provide cover and concealment, be reasonably close and offer good access to designated embarkation points, and facilitate the reembarkation of the force.

f. Fire Support Planning.--Support of the covering force and defense of the embarkation area require the same close coordination of all supporting arms as an amphibious assault. The procedures used in this coordination are essentially the same. (See FMFM 7-1, Fire Support Coordination.) The primary difference is that, in the assault, supporting arms and control facilities are progressively built up ashore. In a withdrawal, the arms and control facilities are progressively decreased ashore until eventually all their functions are performed by units afloat or airborne. However, as control ashore diminishes, the requirement for supporting arms increases. Accordingly, emphasis is placed upon maximum use of external fire support agencies; e.g., air and naval gunfire. Nuclear fires employed both against targets of opportunity and in support of barrier operations can be used to forestall enemy interference. Isolation of the beach, when requisite supporting arms are available, is more readily achieved than during the assault, since enemy troops and weapon dispositions cannot be preplanned or emplaced due to the transitory nature of the operation. Air support requirements include transport helicopters, naval gunfire spotting, close air support, antiair warfare operations, reconnaissance, interdiction, and fixed-wing transport. Forward air controllers with the covering force control airstrikes in support of the withdrawal. In the final stages of the withdrawal, this function is assumed by the tactical air coordinator (airborne). Helicopters used in the withdrawal of the covering force provide the speed and mobility necessary for quick disengagement of forces.

(1) All available fires are planned on known enemy positions and reserves. Fire support is planned to disrupt and disorganize the enemy and retard his reaction to the withdrawal operation. Smoke is used to deceive the enemy as to the disposition of landing force units and to conceal movement in the withdrawal. Nuclear fires placed on the enemy may disorganize him sufficiently to permit elements of the landing force to break contact and assist in preventing or delaying a penetration into the withdrawal area.

(2) Tanks and antitank weapons are employed to engage enemy armor at long ranges, to counterattack enemy elements attempting to penetrate or bypass the covering force, and to cover the withdrawal of elements of the covering force.

(3) Artillery elements cover loading areas by long-range harassing and interdiction fire, support the covering force, and provide fires to assist supported units during disengagement. As infantry forces are withdrawn for reembarkation, supporting artillery units accompany them.

(4) After the withdrawal of supporting artillery, air and naval gunfire supports the final phase of the withdrawal.

g. Supply and Evacuation.--Plans provide for adequate supplies to landing force units in forward positions, but caution is exercised to avoid overstocking. Withdrawing units may transfer supplies to covering forces as they pass through them. Nonmedical supplies that cannot be evacuated are destroyed. Casualties at aid and collecting stations are evacuated before the withdrawal begins. Medical personnel, including those needed to operate aid stations, are attached to covering forces. Casualties within

the covering force are evacuated by helicopter, direct to ships at sea, when feasible. When this is not practicable, they are moved to the beach area for embarkation in landing craft or ships. Care should be taken to perform all possible preventative/corrective maintenance on a continual basis while ashore to ensure rapid evacuation and reliable communications.

h. Movement Plan.--To avoid traffic congestion, a movement plan is prepared and effected upon initiation of the withdrawal. Guides and control posts are provided to ensure smooth and rapid movement to the reembarkation area once the withdrawal starts. Vehicles are initially brought as far forward as practicable to move weapons and ammunition to the rear. The number of vehicles brought forward is held to a minimum consistent with the requirement. Vehicles not needed in forward areas are moved to the rear on prescribed routes. Unnecessary movement that might disclose the withdrawal is avoided. Control of routes of movement is normally exercised at division or higher level. Frequently, however, military police personnel are made available to lower levels for this purpose. Under this condition, lower echelons of the landing force establish a route control system. Positive measures are taken to ensure that all elements in the zone of movement respond to these route control measures.

i. Transportation.--Part of the landing force may be evacuated from the objective area direct by helicopters or fixed-wing aircraft. Normally, a major portion of the withdrawing force is moved to reembarkation points in the beach area by helicopter or truck and withdraws in amphibious shipping. Evacuation to task force shipping is then accomplished by helicopters, amphibious vehicles, landing craft, and landing ships. The covering force is evacuated by the most rapid transportation means feasible under the conditions existing at the time of its withdrawal.

j. Secrecy/Deception.--All daylight activities which might disclose the intention to withdraw, such as abnormal movement of vehicles to the rear or the concentration of shipping off reembarkation beaches, are prohibited. Necessary daylight motor movements to the rear, including reconnaissance, are made by infiltration. Provisions are made to ensure that noise does not betray the withdrawal.

k. Demolition Plans.--Detailed plans are prepared for demolitions along enemy avenues of approach and those routes which lead into beaches designated for withdrawal of landing force units. Particular attention is given to the destruction of bridges and tunnels. Demolitions are placed in defiles and on routes traversing natural and artificial obstacles. Demolition plans include:

(1) Provisions for placing and firing necessary demolitions.

(2) Adequate guards to prevent premature firing of charges or seizure by enemy infiltrators.

(3) Fixed responsibility for the destruction of bridges.

(4) Schedules for destroying bridges no longer needed by the landing force.

(5) Covering by fire, including nuclear fire, those obstacles created by demolition.

l. Communications.--The nature of the amphibious withdrawal places primary reliance on radio communications. The use of wire is planned to compensate for possible enemy electronic countermeasures. Requirements for wire systems are determined during the planning stage. As a minimum, planned wire systems include trunks along routes of movement of major subordinate commands and control elements and integrated systems on all delaying and covering positions. During the initial stages of withdrawal, communication facilities are maintained as long as possible on the old position. When command posts close, march command posts are opened. A small detachment remains to operate communication facilities for the covering forces. When old command posts are closed, wire lines are cut and sections removed to prevent their use by the enemy. Communication personnel are sent ahead of the main body to install wire sets on the next position to the rear which is to be organized for delaying action.

m. Embarkation Planning.--Planning for embarkation of forces, incident to an amphibious withdrawal, is conducted in accordance with normal procedures. (See FMFM 4-2, Amphibious Embarkation.) This planning is predicated on whether the embarkation is to be for combat loading for redeployment in an amphibious operation, or for administrative loading for retirement to a designated base or rear area. The effect of the withdrawal on logistic support is anticipated. Provision is made for adequate support throughout the operation, preventing unnecessary destruction or loss of supplies, establishing priorities for destruction of supplies and equipment not to be evacuated, and ensuring prompt evacuation of casualties. Depending on the availability of fixed-wing transport and airfields in the embarkation area, and the degree of friendly air superiority, emergency resupply and air evacuation can expedite logistic support in the withdrawal. Policies relating to civilian refugee evacuation, when applicable, are formulated early. Civilians concerned are immediately informed of such procedures.

1307. ACTIONS BY THE COVERING FORCE

a. General.--Delaying operations conducted by the covering force are a vital part of an amphibious withdrawal. They are normally conducted to:

(1) Restrict enemy forces and fires from the embarkation area.

(2) Cover the reembarkation of the main body.

(3) Exchange minimum space for maximum time.

(4) Delay the advance of the enemy and force him to repeatedly deploy his forces.

(5) Inflict maximum damage on the advancing enemy without permitting the covering force to lose its freedom of maneuver.

b. Positions.--Positions selected for the covering force should:

(1) Incorporate high ground with good observation and long-range fields of fire.

(2) Be located along existing obstacles and terrain features across the lines of hostile advance.

(3) Have a good road net and/or areas providing good cross-country trafficability to the reembarkation area.

(4) Be far enough apart to cause the enemy to regroup his forces prior to continuing the attack.

(5) Be far enough inland to prevent enemy fire into the embarkation area.

(6) Final positions covering the embarkation must be within supporting range of naval gunfire.

c. Composition.--The composition of the covering force depends largely on the terrain in the area of operations and the nature of the enemy threat. The covering force is strong in tanks whenever possible. It requires mobility equal to that of the enemy and should be strong in artillery and engineer support. A reserve for the covering force should be assigned the missions to:

(1) Counterattack.

(2) Assist a heavily engaged unit in breaking contact.

(3) Provide security forces forward of the delaying position.

(4) Assist in embarkation area security missions.

(5) Provide supporting fires to withdrawing elements of the covering force.

d. Time Phasing.--The time phasing for delay operations conducted by the covering force is dependent on:

(1) The prescribed mission.

(2) The comparative mobility of the enemy and the covering force.

(3) The comparative combat power of the enemy and the covering force.

(4) The natural and manmade obstacles available in the area of operations.

(5) The relationship between the total time delay required and the total space (area) that the covering force has in which to conduct its operation.

(6) The pattern of tactics that the enemy has been employing.

e. Control/Coordination.--The commander landing force determines how long the enemy must be held forward of the reembarkation area; e.g., how long he can realistically expect it will take to reembark his force. Guidance and the mission assigned to the covering force are more detailed than in other types of operations. Overall operational planning and control are centralized. Within the overall plan announced by the commander landing force, subordinate commanders are given maximum freedom of

action. Alert command and staff supervision of operations being carried on by the covering force are required to ensure that adjacent units keep coordinated in the delaying operation. Uncoordinated engagements could quickly lead to units being bypassed or cut off by the enemy. Control measures employed by the covering force include:

(1) Initial delay position (IDP).

(2) Delay lines.

(3) Phase lines.

(4) Coordinating points.

(5) Contact points.

(6) Checkpoints.

(7) Boundaries.

(8) Primary and alternate routes of withdrawal.

(9) Delay positions.

(10) Start points.

(11) Release points.

(12) Traffic control posts.

(13) Fire support coordination lines.

(14) Fire coordination line.

(15) Assembly areas.

f. Logistics.--Supply requirements for the covering force are carefully computed and appropriate measures taken to ensure receipt of supplies at the smallest unit level. Delay operations are characterized by a high consumption of class III and class V supplies. Plans provide for mobile supply distribution points or the prepositioning of supplies along the routes of withdrawal and on intermediate delay positions. The commander of the covering force issues specific instructions regarding the destruction of supplies and equipment that cannot be evacuated and fixes responsibility for their destruction. Combat services support installations are located well to the rear to reduce frequency of displacement and interference with combat activity. The covering force commander makes provision for prompt evacuation of casualties. Helicopters are particularly desirable for evacuation support of the covering force.

g. Engineer.--Engineers may be placed in support of, or attached to, units of the covering force to construct obstacles, prepare rearward positions, and execute barrier plans. Demolition of bridges and other installations is a command responsibility and is closely controlled.

h. Communications.--The primary means of communication for covering force operations is radio. However, every effort is made to prepare wire

and directional signal facilities in the reembarkation area(s) well in advance of their occupation by the main combat elements. Maximum use is made of existing commercial and military communication facilities. Care is taken to destroy commercial facilities before they are abandoned.

i. Conduct of the Delaying Action

(1) The enemy is taken under fire as soon as he is within effective range of available weapons. As he nears the position, all available support fires are increased to inflict casualties, cause him to deploy early, and require him to take time-consuming maneuvers to close with the position.

(2) Each position is defended until the enemy actions threaten decisive engagement. Commanders are alert to detect significant events that may require modificiation of the basic plan. Rigid adherence to plans conceived before the enemy situation develops may prevent the accomplishment of the mission. The original concept of time-phasing may be adjusted to the situation as it develops to seize opportunities, to gain greater delay than anticipated, or to preserve the delaying force against an attack in overwhelming strength.

(3) When maximum possible delay has been achieved and it becomes apparent that further occupation of the position will result in the unit's becoming engaged decisively, withdrawal is begun. Withdrawals may be initiated in accordance with prearranged plans or on order of the higher commander. Affected forces coordinate their actions with adjacent units.

(4) When a unit withdraws to the next delay position, elements provide security for the withdrawing units and continue to provide maximum delay between delaying positions using maneuver, available terrain, long-range fires, tactical air, mines, and demolitions.

(5) The opportunity to inflict heavy casualties on the enemy by offensive action is exploited. Limited objective counterattacks may be employed to gain additional time or to extricate units that have become decisively engaged.

(6) Once the reembarkation of the main body is effected, the covering force disengages from the enemy to effect its own withdrawal. When practicable, this withdrawal is conducted by helicopter direct to amphibious shipping.

1308. EMBARKATION

The embarkation phase of the amphibious withdrawal is based on the type of loading employed. Administrative loading gives primary consideration to achieving the maximum utilization of troop and cargo space without regarding tactical considerations. Combat loading gives primary consideration to facilitating the tactical unloading of troops, equipment, and supplies. Administrative loading is used most often for withdrawal. The amount of detail included in the embarkation plan is determined by the size of the operation, experience of personnel, time available, and the assigned shipping. The principal characteristic of the embarkation phase is centralized control.

a. Control.--Embarkation is controlled by the shore party, which is reactivated, and assigned precise responsibilities, including an officer

in charge of embarkation. This organization for embarkation, including ship platoons and embarkation personnel, provides for maximum coordination and speed in execution. The detailed instructions concerning the embarkation designates the embarkation beaches, establishes a priority system for embarkation, and schedules the movement of units to the beaches. Movement to embarkation beaches is controlled through the use of assembly areas, routes of withdrawal, initial points, and checkpoints. To expedite loading and coordinate the arrival, loading, and departure of landing craft or ships, control agencies at each beach summon and guide units from the assembly areas to the embarkation beaches.

b. Air Evacuation.--Similar procedures are established when helicopters and fixed-wing transport aircraft assist in the evacuation of personnel and equipment from the embarkation area.

c. Embarkation Sequence.--The general sequence of embarkation remains the same whether the withdrawal is voluntary or forced and whether the withdrawal is conducted during the early stages of the amphibious assault after certain command control facilities have been established ashore, or after the termination of an amphibious operation.

(1) Control and coordination are established between the covering force and the forces being withdrawn, in order to permit the smooth flow of units into the reembarkation area with minimum interference to the covering force and its supporting arms. Checkpoints are established by the covering force to control the movement into the beach/landing zone perimeters. Simultaneous with establishment of the defense, embarkation commences for supplies, equipment, and personnel not required for support of operations ashore.

(2) Embarkation continues with a progressive reduction of troop and material strength ashore under the protection of naval, air, and ground covering forces. Depending on the availability of afloat cargo capacity and/or available loading time, material which cannot be evacuated is destroyed prior to final embarkation. To facilitate deception and reduce the effectiveness of enemy observation, part or all of the withdrawal is conducted during periods of reduced visibility. Smoke can be employed to extend such periods. Maximum effort on the part of engineers, shore party, and other logistic support agencies during this period is required to reduce and clear the embarkation area with a minimum of confusion. Naval crews and afloat facilities operate at peak capacity to expedite this stage of the withdrawal.

(3) With the progressive decrease of units ashore, the final withdrawal of the ground covering force commences. Within the covering force, priority for withdrawal is given to heavy units such as artillery and tanks. The withdrawal usually is conducted under cover of darkness and is supported and controlled by elements already afloat. Upon final embarkation of the covering force, the amphibious task force moves away from the objective area. Personnel who are inadvertently or unavoidably left behind employ evasion, escape, and survival procedures to avoid capture. The amphibious task force conducts search and rescue operations, as required, in an effort to locate and evacuate these personnel.

d. Embarkation of Civilians.--Embarkation of civilian refugees or indigenous personnel pose special problems in language, food, clothing, medical service, and billeting of women and children. Normally, civilian

property is not embarked except for individual personal items. Civil affairs agencies assist in the embarkation and provide the necessary liaison between the people and the military commanders concerned. If possible, civilians are employed in food preparation and in providing assistance to medical departments. Separate transport groups are designated to remove these noncombatants from the area of operations.

e. Special Requirements.--During embarkation, additional instructions normally are prepared for the handling of dead and the destruction of supplies and equipment that cannot be embarked. Engineers, ordnance disposal personnel, and underwater demolition teams assist in the preparation of equipment and facilities to be destroyed. These personnel are assigned to the covering force commander and execute demolitions on his orders prior to final embarkation. When dock facilities are used in reembarkation, underwater demolition teams prepare them for demolition after the withdrawal. Harbors are normally mined to delay restoration. If the dead cannot be removed from the area, they are normally buried in a common grave. Identity of personnel and location of the grave are established prior to final embarkation.

f. Tactical Considerations of Withdrawal Under Enemy Pressure and Not Under Enemy Pressure.--The amphibious withdrawal may be made under enemy pressure (involuntarily) or not under enemy pressure (voluntarily). Special considerations are required for each type. Withdrawals not under enemy pressure are normally conducted in conditions of reduced visibility, with as much secrecy as possible; deception plans are employed and key members of the unit rehearse to the maximum extent possible. Planned withdrawals under enemy pressure should be avoided by the commander. For additional details concerning the two types of withdrawals, see FMFM 6-2, Marine Infantry Regiment.

CHAPTER 2

COLD WEATHER OPERATIONS

Section I. INTRODUCTION

2101. GENERAL

The terms "cold weather operations," "arctic operations," and "northern operations" are virtually synonymous. Each refers to an area of the world where conditions of climate and terrain require a landing force to use special equipment and special techniques to operate successfully. (See fig. 6.) While the probability of a landing force being employed in the Arctic may be remote, it is not necessary to conduct operations in arctic areas to encounter deep snow and extreme cold. The First Marine Division at the Chosin Reservoir in 1950 was a long way from the Arctic, yet it encountered temperatures in the vicinity of 20 degrees below zero. Wherever it may be encountered, extreme cold weather presents problems that cannot be ignored. This chapter delineates procedures for the employment of landing force units in an extreme cold weather environment. For a more detailed discussion of cold weather characteristics, see FM 31-70, Basic Cold Weather Manual, and FM 31-71, Northern Operations.

2102. CHARACTERISTICS OF NORTHERN AREAS

Northern area operations are influenced by:

a. Snow Cover.--Snow cover restricts normal movement and operations of landing force units. While it makes concealment more difficult, snow facilitates deception and changes the contours of the ground. Snow cover reduces the effects of supporting fires.

b. Ice Cover.--Freezing of rivers, lakes, and swamps increases possibilities for movement. Some waterways which are obstacles in summer are the best routes of advance and lines of communication in winter.

Figure 6.--Arctic and Subarctic Areas of the World.

c. Extreme Cold.--The effects of extreme cold numb personnel, increase the need for maintenance of material and weapons, and slow up activities. These factors are important considerations when making time and space calculations.

d. Sharp Variations in Weather.--Sudden changes in weather are common. Changes include severe frosts, mild weather, sudden freezing, snowstorms, strong winds, and dense fog. Accurate weather forecasts are essential.

e. Daylight and Darkness.--Short days and long nights decrease the amount of daylight available for working and fighting in winter. Nights are often made bright by the moon, northern lights, and stars. In summer, the short nights may permit landing force operations throughout the entire 24-hour period.

f. Seasonal Transition.--Seasonal transitions, both summer to winter and winter to summer, produce radical changes in the operational environment. Careful planning to compensate for such changes is essential. Otherwise, the landing force may be immobilized for extended periods.

g. Sparse Settlement.--Industries, supplies, quartering facilities, and lines of communication are limited.

h. Lack of Roads and Railroads.--Roads and railroads are almost nonexistent. Those that do exist are poorly constructed and susceptible to easy destruction.

i. Numerous Lakes and Waterways.--Frozen lakes and waterways offer a good substitute road system. Snow is easily plowed on ice. Roads thus made may be used to reach points from which to attack. Frozen waterways also provide natural airstrips.

j. Lack of Maps.--Maps are frequently nonexistent or very unreliable. This makes operational planning difficult and places special emphasis on reconnaissance and navigation. The importance of aerial photos is increased.

k. Difficulty of Navigation.--Difficulty of navigation is caused by magnetic disturbance. The sameness of subarctic forests and snow covered tundra add to the difficulties.

l. Arctic Whiteout.--At times, an overcast sky and snow covered terrain create a condition of visibility which makes recognition of irregularities in terrain very difficult.

m. Forested Areas.--The large forest areas in the subarctic have a considerable effect upon landing force operations. They offer concealment for defensive positions and supply installations. They also provide comparatively good protection against bad weather conditions.

2103. TERRAIN AND HYDROGRAPHY

In subarctic regions, erosion by glaciation and weathering has produced rugged and irregular shorelines. There are many fiords, coves, deep inlets, and offshore islands, as well as vast areas of prairies, lakes, rivers, forests, and inland mountains. Soil is often thin and is underlaid

by permafrost or permanently frozen soil and rock. In summer, the ground above the permafrost thaws. This produces a multitude of small shallow lakes and ill-defined meandering streams which freeze over during the winter. Vegetation varies from large, heavy, generally coniferous forests to scrub growth, grass, and tundra.

a. Sea Ice.--Sea ice is an ever-present hazard to shipping in the extreme cold weather environment. As a result, continuous ice reconnaissance is mandatory. Aerial reconnaissance using helicopters is particularly effective for locating sea ice and determining ice thickness.

b. Beaches.--Sandy beaches are rare in the subarctic. The rocky nature of most subarctic beaches necessitates detailed reconnaissance to detect the presence of hazardous boulders. Glacial action has left many coastal areas with large numbers of rocks and boulders on the beach and hinterland surfaces so that there are many obstacles to beach operations and to operations in which the beaches are crossed.

c. Hydrographic Information.--A serious problem during operations in extreme cold areas is the scarcity of accurate hydrographic information. Charts which do exist are frequently inaccurate in both location and details of coastlines. Soundings on charts may be scarce or nonexistent.

2104. WEATHER

While all weather factors are considered in planning amphibious operations, those which exert the greatest influence on landing force operations are the extreme temperatures, seasonal transition, high winds, and fog.

a. Types of Cold.--Weather in cold environments is categorized as wet cold, heavy winter, or arctic dry cold.

(1) Wet Cold.--In wet cold, temperatures range from 20 to 40 degrees Fahrenheit with short periods of lower temperatures. Snow remains on the ground for only short periods. There is much humidity and precipitation, fog, rain, and snow. The ground alternately freezes and thaws, and is generally wet and muddy.

(2) Heavy Winter.--In heavy winter, temperatures average from 25 degrees Fahrenheit down to 5 degrees above zero. Occasionally, temperatures are much lower. There is moderate snowfall, remaining on the ground for extended periods. The ground generally remains frozen.

(3) Arctic Dry Cold.--In arctic dry cold, temperatures range from zero to 40 degrees below zero. There is a moderate, dry snowfall with depths to 4 or 5 feet and drifts much deeper. The ground is deeply frozen. Streams and rivers are frozen.

b. Temperature.--Temperature ranges are greatest in continental areas, least over areas where there is open water throughout the year. In areas where surface frost melts in summer and subsurface permafrost remains, the melted surface water is held so that areas take on the characteristics of ocean areas and do not have extremes in temperature. In areas that are clear of snow and ice, temperatures may remain well above

freezing allowing absorption of solar energy and storage of heat. Inland temperatures in midsummer may reach 110 degrees Fahrenheit in Canadian and Alaskan valleys. Temperatures in coastal areas may reach a maximum of 75 degrees Fahrenheit. In winter, the entire surface of the subarctic is covered with snow and ice except for the large ocean areas. Temperatures are consistently in the subfreezing range.

c. Humidity.--In coastal areas of the subarctic, humidity is high because of the open water areas. In winter, humidity is low over snow and ice surfaces.

d. Wind.--Prevailing and local wind speed and direction vary widely in different areas. These variations are produced by the topography and by air masses or fronts in the area. An outflow of continental air usually brings more favorable weather inland than does an onshore flow of maritime air. When a low pressure center moves from ocean areas inland, there is a flow of maritime air from behind it. Rough weather often results. Increasing winds and clouds may be an indication of approaching storm conditions.

e. Fog.--There is more fog in summer months than at any other time of the year. Fog in summer is dense and tenacious, sometimes persisting in winds of 50 miles per hour or more. It occurs most frequently with the movement of warm air over cold water. Over open sea areas in the early winter, the interaction of intensely cold outbursts of air from the interior with relatively warm water produces sea smoke. This type of fog is seldom deep. It is rapidly dissipated by turbulent air. Sea smoke normally occurs with an upslope wind. Fogs are more frequent in the late night and early morning hours than at any other time. Minimum incidence occurs at noon or shortly thereafter. Fog formed over open water areas may envelop coastal areas when the wind shifts to an onshore flow.

f. Cloudiness.--Cloud heights are lower in high latitudes than in temperate zones. Ceilings of 1,600 feet are not uncommon. Cloudiness is greatest in summer and fall; least in winter and spring.

g. Precipitation.--While there is little precipitation along arctic coastal areas, the ground remains very wet throughout the summer months because of poor drainage. Snow may fall in any month, but rain falls only from June through September.

h. Mirages.--As daylight and twilight lengthen in polar regions in the summer, temperature inversions produce well defined mirages.

i. Blinding Snow.--Blinding snow is a hazard to all operations. Winds of 9 to 14 miles per hour raise the snow a few feet off the ground. This blowing snow obscures surface objects. Winds of 15 miles and over raise the snow to greater heights. With high winds, all movement is impossible. The blowing snow penetrates most types of buildings and equipment.

2105. EFFECTS OF COLD WEATHER AREAS ON LANDING FORCE OPERATIONS

a. General.--The landing force faces no changes in tactical doctrine or principles for cold weather operations. The commander's responsibilities are increased by the extremes of the environment. Difficulties of terrain, visibility, and climate complicate command. Maneuver, supporting

fires, supply, and evacuation require detailed knowledge of the regions to properly apply basic tactical principles. Resourceful leadership, proper training, suitable equipment, and a positive approach to operations can convert natural difficulties into relative advantages. The effects of cold weather areas on landing force operations are considered in terms of three separate and distinct types of operations; i.e., winter operations, summer operations, and seasonal transition operations.

(1) Winter Operations.--Conditions of extreme cold and snow create a constant need for cold weather clothing, heated shelters, tracked vehicles, and cargo sleds. Individuals and units are trained in the use of skis, skijoring (towing of personnel on skis), snowshoes, trail breaking, combat techniques in deep snow, construction of winter roads, employment of ice minefields, and other special techniques required in the specific area of operations. Frozen waterways, swamps, and muskeg provide natural avenues of approach for ground forces and landing fields for aircraft. Short daylight and frequent snowstorms provide excellent concealment for movements, even in open terrain. The most suitable time for operations in the north is usually from midwinter to early spring before the breakup period begins.

(2) Summer Operations.--In the summer, extensive swamps, muskeg areas, lakes, and rivers act as barriers to overland movement. This generates a requirement for bridging equipment, amphibious vehicles, boats, and rafts. In the absence of roads, maximum advantage is taken of inland waterways for transportation of troops and supplies. Helicopters and fixed-wing aircraft assume increased importance. Aircraft equipped with pontoons are advantageous. Almost continuous daylight requires special care in movement, particularly in areas of barren tundra.

(3) Seasonal Transition Operations.--During the spring transition period, ice melts. Temporary winter roads, ice routes, and airfields disintegrate. Winter field fortifications become unusable. During the fall transition period, transport by watercraft ceases due to freezing of inland waterways. At the same time, the ice is usually too thin to permit use as ice routes. Frozen mud on roads create severe conditions for wheeled and tracked vehicles. The number of vehicular breakdowns increases. Cross-country movement is limited until the ground and water are sufficiently frozen. Reduced loads and strict traffic control are required. Before the transition begins, a repositioning of tactical elements may be necessary to cope with changes in terrain conditions; i.e., a frozen river in the winter may become an obstacle in the spring. Careful advance planning to position ammunition and other supplies in the vicinity of the using units is frequently necessary. Large-scale operations during the breakup and freezeup seasons are usually considered risky and may have to be postponed.

b. Personnel.--Operations in the snow environment of the northern latitudes will require careful selection of personnel on an individual basis. Even then, casualties will be great. For example, it is well established that men who suffer from certain physiological disorders are not only handicapped in cold climates, but their health is seriously impaired. The psychological effects on man should not be blandly disregarded either. Experience and scientific studies made from previous operations indicate that it is not a myth that can be simply overcome through training. In addition to the basic physical and mental prerequisites for the combat Marine, individuals should be free from the following physical defects or

limitations: circulatory diseases affecting the extremities, skin grafts on the face, inner ear difficulties, and previous history of severe cold injury. Individuals trained for, and to be assigned to, specific duties not involving frequent or prolonged exposure to the elements may be treated as exceptions to the above. Personnel who have displayed a degree of mental instability or lack of adaptability, which are insufficient to be considered as special cases elsewhere, frequently create much greater problems in northern areas. While limitations in this area are most difficult to delineate, the factors exist and cause sufficient problems to warrant consideration and possible rejection.

(1) Replacements.--Replacements for landing force elements require cold weather training. Training is presented under weather and terrain conditions similar to those of the projected area of operations. Special clothing and equipment are issued during the training period and shipped with the replacement to ensure proper fit.

(2) Morale.--Extremes in temperature, light, darkness, and long periods of isolation are factors which have a marked effect on morale in northern operations. Aggressive leadership at all levels is essential to surmount the obstacles which impede the provision of basic necessities required to maintain good morale. The health of each Marine and confidence in his ability to meet the rigors of mountains, muskeg, and cold is related directly to his physical condition. The effect of physical fitness on morale cannot be overemphasized.

c. Intelligence

(1) Combat Intelligence.--Normal intelligence procedures delineated in FMFM 2-1, Intelligence, are applicable to cold weather operations. Accurate information of the enemy is required concerning his unit's oversnow capability, the type and efficiency of winter clothing and equipment, the type and capability of oversnow vehicles and equipment, and the techniques employed to reduce weather casualties. Visual and photoreconnaissance by air may disclose enemy supply routes, supply installations, troop concentrations, and command and control facilities.

(2) Counterintelligence.--During winter, the barren environment, small size of communities, and increased problems of survival make detection of agent activity comparatively easy. Camouflage is made more difficult. Troop installations and weapons are disclosed by the presence of ice fog. Roads and trails in the snow are easily identified from the air.

(3) Weather and Terrain.--Weather and terrain have a decided effect on the work of the intelligence officer in the north. Severe temperatures, snowstorms, and blowing snows are often an advantage to the attacker. In areas of rapidly changing weather, reports are made frequently and analyzed for their effects on operation plans. Studies of the terrain used in conjunction with weather forecasts have a major influence on the development of plans. Sudden changes in conditions, especially those concerning approach routes in winter, must be detected and disseminated by the intelligence officer.

(4) Maps.--Very little of the northern area is mapped with sufficient accuracy to provide tactical maps for landing force units.

During the initial stages of the operation, these units may be forced to rely on airphotos, mosaics, and photomaps.

d. Organization.--Many landing force elements require some modification in organization prior to employment in the north. This modification may consist of merely adding or deleting a few men. In some cases, it may necessitate the addition or deletion of entire units. The extent of modification depends on the mission of the unit, location of the operational area, nature and function of the unit, required equipment or weapons, and the time of year. Cold weather operations will demand independent operations by battalions and companies. There will be additional direct support attachments to these units which must be administratively and logistically supported at that level.

e. Peculiarities of Operations.--Cold weather operations are best planned and conducted with a complete understanding of variations from normal. Among the characteristics considered in such operations are:

(1) The effects of errors or miscalculations in planning may be disastrous; remedial action is difficult to accomplish.

(2) The use of air transport facilities for supply and evacuation; in some circumstances, air transport is the only practicable method.

(3) Detailed reconnaissance prior to committing the landing force avoids delay, misdirection of effort, and subsequent exposure of troops to cold and fatigue.

(4) Personnel and supplies are carried as near to the enemy as is possible by either surface or air transport.

(5) Sufficient forces are employed to ensure the complete success of the initial assault.

(6) Plans provide for alternate means of logistic support; requirements for fuel, shelter, and clothing increase, and special equipment and/or the modification of standard equipment is often necessary.

(7) Only minimum essential supplies and equipment can be moved; supply economy is achieved by self-sufficiency and maintaining austere living conditions.

f. Reconnaissance.--Extensive day and night aerial visual and photographic reconnaissance is indispensible in prolonged cold weather operations. Close-in ground reconnaissance is essential, but the mobility of ground reconnaissance elements is restricted and they are vulnerable to ambush and delaying tactics. Ground reconnaissance troops require oversnow vehicles and light loads in order to carry out their assigned tasks.

g. Movement.--Movement on foot is difficult in heavy snow and extreme cold. Skis and snowshoes may be required for the varying conditions of snow and types of terrain to be traversed. Oversnow vehicles are substituted for wheeled vehicles to the maximum extent practicable. Helicopters are used for liaison, supply, evacuation, reconnaissance, troop movements, and/or messenger service.

h. Weapons and Equipment.--Most infantry weapons are suitable for use in the north and require only minor modification and winterization.

Tracked vehicles can normally be employed effectively in cold weather areas. Wheeled vehicles become useless when the snow depth exceeds 30 centimeters on roads. Winter roads must be established if wheeled vehicles are to be used. Also, tracked vehicles and cargo sleds are substituted for wheeled vehicles and trailers for cross-country movement whenever they are available. Forests and deep snow make the use of tanks difficult and sometimes impossible. Deep snow retards tank movement unless tanks are equipped with special tracks and grousers. Turret mechanisms and elevating and traversing mechanisms operate with difficulty in cold weather. The most effective type of fire in deep snow is direct fire. Impact bursts of artillery are less effective because of the dampening effect of deep snow. All fuzes become unreliable at temperatures lower than minus 20 degrees Fahrenheit.

i. Nuclear Weapons.--Climatic conditions in the winter in northern latitudes increase the blast effect of nuclear weapons. This is especially true when ground surfaces are covered with frozen or wind-packed snow. Thermal radiation ranges may be extended by reflection from snow, and the reflectivity of snow surfaces may create opportunities to exploit loss of night adaption and dazzle caused by the intense light of a nuclear weapon explosion. On the other hand, climatic conditions which require the individual to wear special clothing mitigate against increased casualties from flash burns. Moreover, neutron induced activity in the underlying soil tends to be reduced by any ground cover of ice or snow. The high winds in these latitudes frequently extend fallout areas.

j. Chemical Weapons

(1) Although special preparations, equipment, and techniques of employment may be required, chemical agents may be employed to support offensive and defensive operations. Some agents present a storage problem in extreme cold. Impact-detonating ammunition buries in the snow and the chemical agent tends to be smothered. Because of this smothering effect and the low temperature, less vapor is produced; however, the low temperature increases the persistency of the chemical agent in both liquid and vapor form. A moderate to heavy snowfall over a layer of chemical agent may allow for comparatively safe movement across the area until the layers are churned up or melted.

(2) Persistent chemicals have limited usefulness because thick arctic clothing prevents the liquid agent from reaching the skin. Shelters and fortifications that troops may require for protection against extreme cold will provide some protection against a persistent chemical, but are vulnerable to a nonpersistent chemical. Nerve agent GB stays close to terrain in extreme cold and may be absorbed into cold weather clothing. The GB may later vaporize in heated shelters and vehicles and cause casualties. Since the length of persistency is increased as a result of the cold weather, the use of ice and snow for human consumption should not be attempted once chemical agents have been used because of the residual agent hazard that will exist. Low temperatures will reduce masking efficiency, which makes necessary an efficient chemical alarm and alert system.

k. Security.--Gaps between units require continuous security. Patrols, observation posts, electronics surveillance means, and the air reconnaissance effort are integrated to provide complete coverage. Any suspicious trail or activity is checked and reported to adjacent units as soon as possible. Roads, routes, and trails leading from enemy positions

to friendly flanks are kept under constant surveillance. When feasible, routes may be blocked by obstacles and covered by fire. Observers are alert for suspicious enemy air activity on the flanks of the landing force. Air observers look for signs such as enemy campfires or ski trails, tracks, etc. Requests are made for both day and night air observation missions to detect enemy troop movements and activities in enemy rear areas.

l. Offensive Operations

(1) Offensive operations are directed toward the complete annihilation of the enemy in the least possible time. Consequently, a greater superiority of force is required than is considered essential for normal operations. An operation that is permitted to lag may result in a stalemate or an opportunity for the enemy to seize the initiative. Opposing forces usually meet in a small area with both forces retaining freedom of maneuver. Surprise flanking and turning movements are usually possible.

(2) Skillful exploitation of weather conditions increases opportunities for surprise attacks. This includes the exploitation of falling snow, blizzards, fogs, and low clouds for concealment of troop movements and of good snow conditions for the movement of troops on skis. With reliable weather forecasts, the effects of unfavorable weather can be reduced.

(3) Oversnow mobility and capabilities are fundamental factors in planning. They affect the manner and type of attack, and the selection and depth of objectives. They also affect the capabilities of the enemy to react to an attack.

m. Logistics

(1) Supply.--Extreme cold weather conditions magnify all normal supply problems. Critical points in the supply plan are anticipated and provision is made for possible contingencies. Failure to deliver supplies to landing force elements at the proper time may cause the entire operation to fail. Heated storage is required for many items of supply, notably medical supplies.

(2) Medical Support.--Plans for medical evacuation provide means for keeping patients warm during the process of evacuation. Medical installations are kept well forward and displace frequently to keep up with the progress of assault elements. The number of medical installations may have to be increased to shorten evacuation distances. Light aircraft and helicopters may be used to speed up evacuation from forward areas. Evacuation policy of the northern theaters may be reduced to 5 days or less because of logistic difficulties.

(3) Transportation.--Lack of adequate road nets and difficulty of movement add to the problems of the logistic officer. In addition, road maintenance is more difficult. Movement of supplies is accomplished by a combination of oversnow and wheeled vehicles, overland trains, tracked vehicles, sleds, aircraft, and animal transportation.

(4) Service.--Providing shelters for troops, command posts, mess facilities, and medical and service installations increases overall logistic requirements. In addition, most of these shelters require heat, thus adding to the fuel requirements of the force.

(5) Maintenance of Equipment.--Cold weather operations are characterized by the requirement for a considerable amount of specialized equipment such as clothing, tracked vehicles, sleds, and heated shelters. Every item of equipment used in the northern operation is affected by extreme cold and snow in winter; and heat, mud, and water in summer. The extensive amount of equipment needed and the adverse seasonal effects produce serious maintenance problems. Operations of any type of mechanized device or vehicle under extreme cold conditions are vastly different from the operations of the same mechanical device or vehicle under temperate conditions. Heated shop facilities are essential. Repair parts are required in larger quantities than normally provided. The maintenance performed on equipment in the field under extreme climatic conditions requires considerably more time than under temperate conditions. Special emphasis is placed on the timely performance of required organizational maintenance when operating under extreme cold weather conditions.

Section II. SURVIVAL IN COLD WEATHER ENVIRONMENT

2201. GENERAL

Landing force elements employed in an extreme cold weather environment complete individual and unit training prior to beginning cold weather training. Cold weather training is primarily concerned with teaching the individual Marine how to take care of himself and his equipment so that he can survive, function, and fight in extreme cold. This training falls into two categories: summer training and winter training. Because of the special factors introduced by snow and extreme cold, winter training differs more widely from that for conventional areas of operations than does summer training. It demands a higher standard of physical fitness. Emphasis is placed on conducting as much training as possible out of doors. Troops trained under winter conditions are fit for summer conditions; the reverse is not necessarily true. Training to familiarize troops with special equipment precedes unit training in the application of northern techniques. Preliminary training in using special equipment and several other subjects may be taught anywhere without snow and cold, thus gaining time for technical and tactical training. For winter operations, emphasis is placed on training during hours of darkness, because most operations are conducted during darkness and periods of low visibility. This section outlines the more important survival problems confronting the Marine in an extreme cold weather environment. For a more complete discussion, see FM 31-70, Basic Cold Weather Manual, and FM 31-71, Northern Operations.

2202. PHYSICAL DANGERS

Physical dangers attendant to amphibious operations in an extremely cold environment include:

a. Windchill.--Windchill, or the combined cooling effect of wind and air temperature on humans and animals, is the rate of cooling by which body heat is dissipated. This loss of heat through convection is increasingly accelerated in ascending wind velocities. It is a more factual and practical way to express the effect of weather than by temperature alone.

(1) Windchill Factors.--Windchill is expressed in kilogram calories per square meter per hour. The windchill nomogram depicted in figure 7 shows the windchill factors ranging from 50 to 2,500. When the windchill rises to 1,300 to 1,400, frostbite is a danger even to trained troops. A windchill factor of 2,000 (e.g., temperature minus 40 degrees Fahrenheit and wind 11 knots) is dangerous, and the exposed areas of the face must be protected. Calm weather in extreme cold can be very pleasant. When there is no wind and the temperature is minus 30 degrees Fahrenheit, the windchill factor is approximately 1,000. As an example of the tremendous effect of wind, a velocity of 20 knots with a temperature of 5 degrees Fahrenheit has more cooling effect (1,400) than a 2-knot wind with a temperature of minus 40 degrees Fahrenheit (1,450).

(2) Protection.--Windchill is most dangerous to personnel in exposed positions. The susceptibility of individuals to windchill is increased by cumbersome cold weather clothing which retards physical activity. Discomfort from windchill can be alleviated by providing expedient shelter and warmup facilities at positions and by frequently rotating

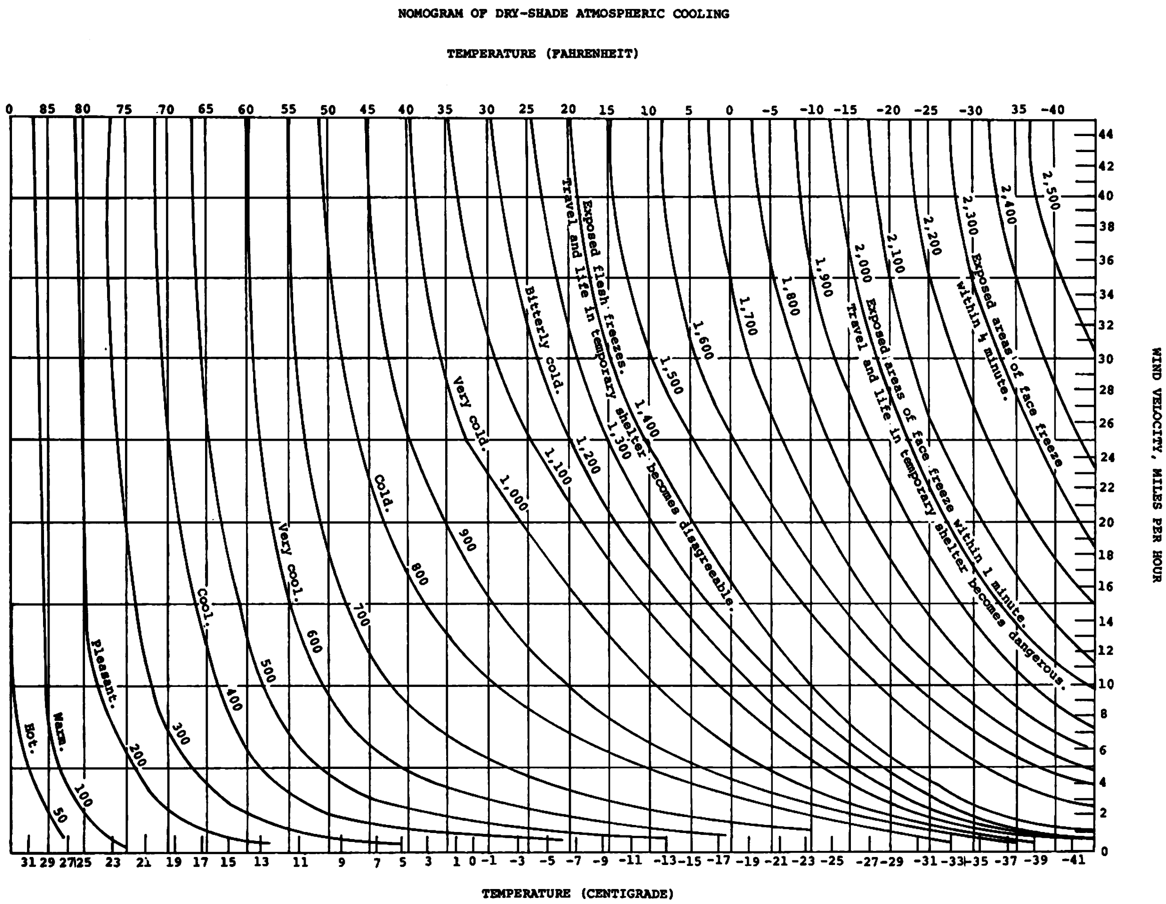

Figure 7.--Windchill Nomogram.

personnel between exposed and protected areas. All personnel are trained to recognize the danger of windchill and to take appropriate preventive actions.

b. Immersion and Exposure.--One of the greatest dangers to personnel engaged in amphibious operations in cold waters is immersion. The average time of survival in the coldest water (28.5 degrees Fahrenheit) is approximately 15 minutes. No time can be lost in applying treatment after rescue. When feasible, the victim of immersion is undressed immediately and placed in warm water (105-110 degrees). The victim is then dried and placed in warm blankets. When exposed to dangerously low temperatures for long periods, individuals are rewarmed rapidly. More gradual rewarming is acceptable when the immediate danger from extremely low temperatures has passed. Individuals exposed to moderately cold temperatures for long periods are rewarmed much more slowly, preferably by the use of heated blankets or heated pads.

c. Cold Injuries.--Cold injury is given many names: freezing, frostbite, trenchfoot, chilled feet, and/or immersion foot. In general, the injury is nearly the same in each case.

(1) Types of Cold Injuries.--From a military standpoint, there are two principal cold injuries, trenchfoot and frostbite. They are differentiated by the recorded temperature.

(a) Trenchfoot.--Trenchfoot, a more subtle form of cold injury, is more common. It can occur in any part of the world where persons may be exposed to temperatures below 50 degrees Fahrenheit. In such temperatures, the body begins to lose heat. There is an automatic constriction in blood vessels of the arms and legs, with a corresponding reduction in blood flow to these parts. The greatest effect is seen in the feet. As trenchfoot develops, the body feels cold all over. The feet first become cold, later red and painful. After a number of minutes, the pain disappears, and the feet become pale and numb. Then the feet swell and take on a waxy appearance. When the feet are rewarmed, there is a reversal of symptoms. The pain returns, the color often changes to blue or purple, and blisters may form on the swollen feet.

(b) Frostbite.--In frostbite, the flesh of the affected part of the body crystallizes into ice, usually at temperatures below 20 degrees Fahrenheit. It is only after thawing that the full extent of the injury becomes apparent, with pain, swelling, leaking of certain blood vessels, and quite commonly, gangrene.

(2) Unit Prevention.--Essential elements of cold injury prevention at the unit level include:

(a) Provision of ample supplies of clothing and footgear which are properly sized, well fitted, correctly worn, and always readily available.

(b) Readily available warmup facilities.

(c) Maintenance of good foot discipline and good clothes discipline.

(d) Close supervision at the small unit level and periodic spot inspections by commanders at all levels.

(e) Rotation of individuals within their units, and the rotation of whole units out of forward positions.

(3) Individual Preventive Measures.--At the individual level, the cardinal principles of prevention are:

(a) Do not stand or sit with feet in cold water.

(b) Keep the feet moving.

(c) Take off boots frequently to massage the feet.

(d) Cut down on smoking (nicotine causes dangerous additional constriction of blood vessels in feet and legs).

(e) Dress warmly.

(f) Maintain insulation of clothing by keeping it clean, dry, and in a good state of repair.

(g) Change to dry socks daily and/or whenever socks become wet.

(4) Emergency Treatment.--The most effective first aid consists of rapid warming at body temperature. Affected parts should not be rubbed with snow. Rapid warming is best accomplished by placing the cold foot against a warm part of the body. Warmer heat such as fire or a stove is not used. The hazard of actual burns during this time is great.

d. Lung Frosting.--Deep breathing through the mouth at temperatures of minus 25 degrees Fahrenheit and below may result in damage to the trachea and upper respiratory tract. When heavy breathing occurs, personnel may breathe the warm air from inside of a sleeve until the deep respiration stops. Smoking contributes to lung frosting and is discouraged during periods of extremely low temperature.

e. Shock.--The normal reaction of the body to severe cold and the reduction of the volume of blood circulating to the extremities is similar to the condition of shock. Shock usually develops more rapidly and progresses more deeply in extreme cold than in normal temperatures, particularly in the case of wounded and/or injured personnel.

(1) Signs of Shock.--Signs of shock include apprehension; sweating; pallor; rapid, faint pulse; cold, clammy skin; and thirst. Immediate first aid treatment is mandatory.

(2) First Aid.--In case of shock:

(a) Make the injured person as comfortable as possible.

(b) Relieve pain by proper positioning, good bandaging, and splinting. Aspirin or morphine is administered as required.

(c) Position the stretcher so that the casualty's head is lower than his trunk and legs.

(d) Keep the casualty warm with blankets and/or sleeping bags.

(e) If the patient is conscious, give him warm soup, chocolate, coffee, or tea.

(f) Get the patient to medical attention as soon as possible.

f. Sunburn.--The individual Marine may get sunburned when the temperature of the air is below freezing. Sunlight reflected upward from bright surfaces attacks sensitive skin around the lips, nostrils, and eyelids. Sunburn cream and a chapstick are carried and applied as needed. Soap or shaving creams with a high alcoholic content are not used. They remove natural oils that protect the skin from the sun.

g. Snow Blindness.--Snow blindness may occur when the sun shines brightly on an expanse of snow. It is caused by the reflection of ultraviolet rays. It is particularly likely to occur after a fall of new snow, even when the rays of the sun are partially obscured by a light mist or fog. In most cases, snow blindness is due to negligence or failure of

the individual Marine to use sunglasses. Symptoms of snowblindness are a sensation of grit in the eyes, pain in and over the eyes, watering, redness, headache, and photophobia. The treatment is application of cool, wet compresses to the eyes, and then wear a pair of dark glasses. Eye ointment will relieve the burning and pain, but does not improve vision.

h. Carbon Monoxide Poisoning.--During cold weather operations, the use of a stove, fire, or gasoline heaters in restricted areas may result in carbon monoxide poisoning. A steady supply of air in vehicles and in living and working quarters is vital.

(1) Symptoms.--Generally, there are no visible symptoms of carbon monoxide poisoning. With mild poisoning, there may be headaches, dizziness, yawning, weariness, nausea, and ringing in the ears. Later the heart begins to flutter or throb. However, the gas may hit without any warning. Men may be fatally poisoned as they sleep.

(2) First Aid.--In case of carbon monoxide poisoning:

(a) Move the victim to fresh air at once.

(b) Put the victim into a sleeping bag for warmth.

(c) Do not exercise the patient; this increases the body's requirements for oxygen.

(d) Apply artificial respiration if victim stops breathing or breathes in gasps.

(e) Apply pure oxygen if available.

(f) Keep the victim quiet and warm for at least 1 day after exposure.

(g) Use heat to maintain body temperature.

i. Excessive Perspiration.--If perspiration is not controlled, ice forms in clothing, and the portion of the body exposed to such ice chills quickly. Both clothing and body should be dry before exposure to extreme cold. Too much clothing is not worn indoors and shelters are not overheated. Overexertion is avoided when possible.

j. Handling Metal Objects.--Although hands may appear dry, they can freeze to very cold metal surfaces. This can cause painful tearing of the flesh. Anticontact gloves are worn when handling cold metal objects.

k. Fuel Handling.--Gasoline spilled on the hands or clothing in below zero weather freezes flesh in a matter of seconds after contact. Care is exercised when fueling, pulling strainers, and draining tanks.

l. Fire.--Fire is a constant threat to survival in any extreme cold weather environment. Firefighting in the winter in the subarctic may be almost impossible. Whole units could conceivably be left with little food, clothing, or shelter. The hazards of fire are reduced by indoctrinating landing force personnel in fire prevention. Provision is made for the dispersal of medical supplies and equipment in order to counteract the effects of an uncontrolled fire. Provision is also made for caches of food, tents, and sleeping bags in the event a bivouac is destroyed.

2203. WATER

While several sources of water are found in the arctic, treatment of water under subarctic conditions is difficult and distribution is a major problem.

a. Sources of Water.--Surface water is available from streams and lakes, and ground water is available from springs and wells. Waterpoints on lakes or rivers are located on the leeward side where the water is generally clearer, where there is less drift snow, and where there is shelter from the wind. Other sources of water include distilled salt water, fresh water ice and snow, or old sea ice. Ice is preferable to snow as it yields more water for a given volume. Normally, melting ice and/or snow for troop use is prohibitive because of the large amount of fuel required to obtain a small amount of water.

b. Water Purification.--All water is considered unsafe until proven otherwise. Low turbidity of the water makes it possible to provide safe water by chlorination without other previous treatment. Filtration is normally accomplished by means of an improved diatomite or ceramic filter. A hot-air type of heater is required to heat the tent housing the water purification unit so that the pumps, hoses, and fittings are thawed and in operating condition at all times.

c. Water Distribution.--Distribution of water is a major problem encountered during periods of below freezing temperature. The use of 5-gallon water cans filled to about 75 percent capacity to permit agitation is normally acceptable. Heated storage is required for water cans during freezing weather.

2204. SHELTERS IN COLD WEATHER OPERATIONS

In order to carry out amphibious operations in cold weather and maintain a high level of combat efficiency and morale, heated shelter is essential for all troops. Amphibious planning provides for the earliest practicable landing of such shelters. They are positioned as close to the positions for forward landing force elements as possible and arrangements are made for the periodic rotation of assault troops from battle positions to warmup areas. Bivouac shelter areas are organized in accordance with the procedures delineated in appendix B.

a. Tents.--The size and type of tents available to the landing force in a cold weather operation are an important consideration. They should be light enough to be transported by manpower when necessary and large enough to keep the total unit load down. When larger tents are used, the number of stoves required is smaller and fuel consumption less than needed for heating a larger number of smaller tents. Large tents also reduce fire watch requirements and present a lesser camouflage problem, though security from attack is less.

(1) Two-Man Mountain Tent.--The mountain tent is very light and provides excellent warmth. A candle or heat tab will warm the tent. It weighs 8 pounds, has a camouflaged white and brown side, and rolls into a small package. Also, there are one-man, five-man, and 10-man arctic tents which are easily carried by small units. (See fig. 8a.) Caution: Carbon-monoxide poisoning can occur with insufficient ventilation.

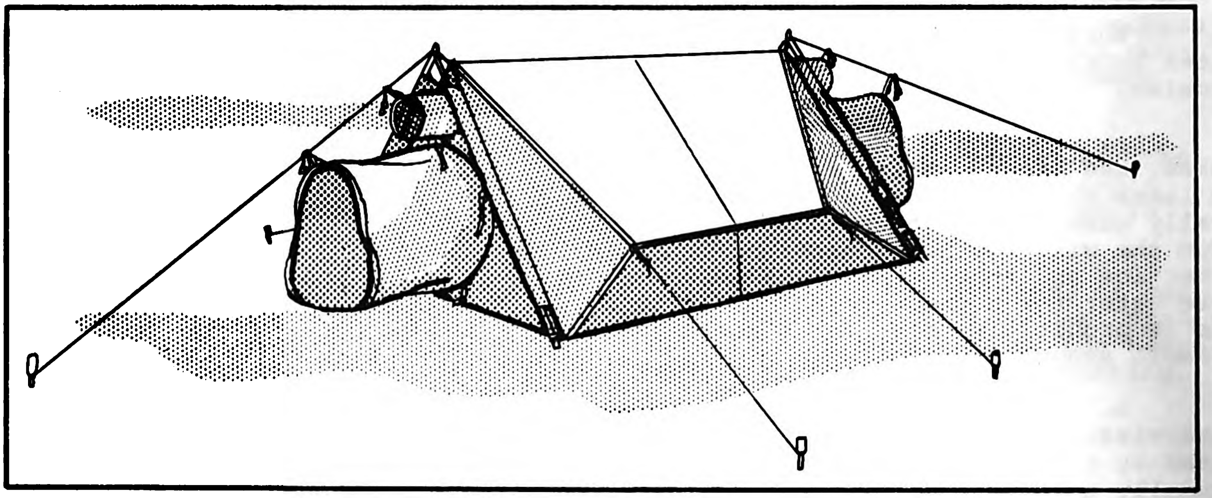

Figure 8a.--Two-Man Mountain Tent.

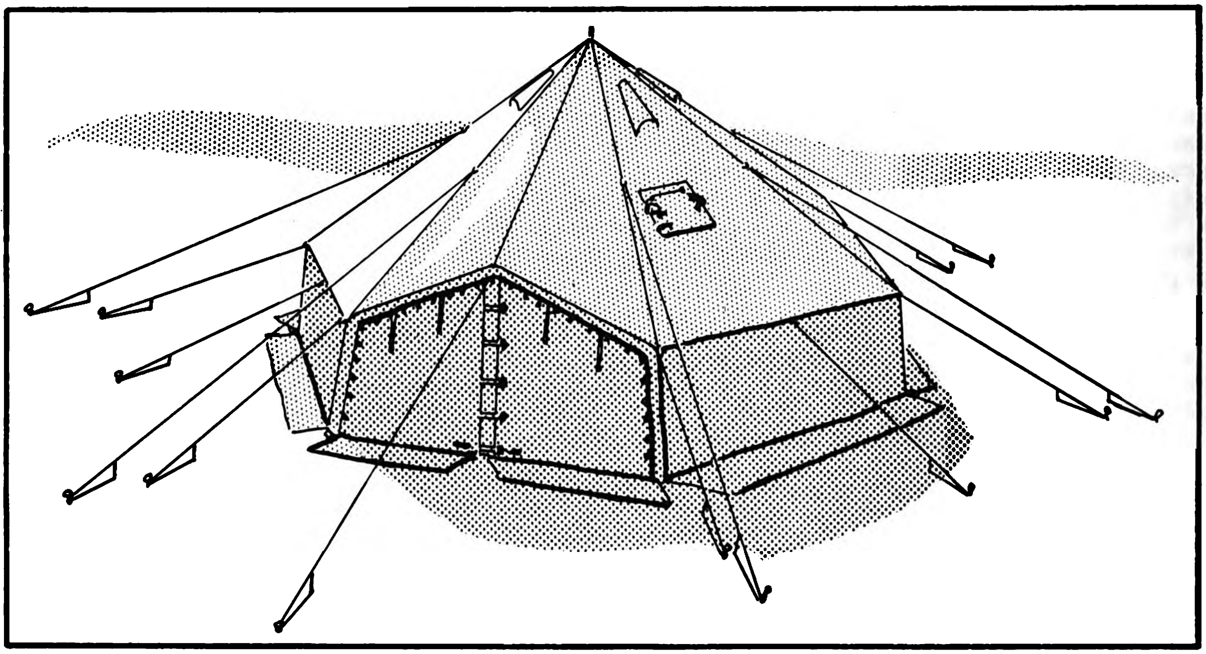

Figure 8b.--Ten-Man Arctic Tent.

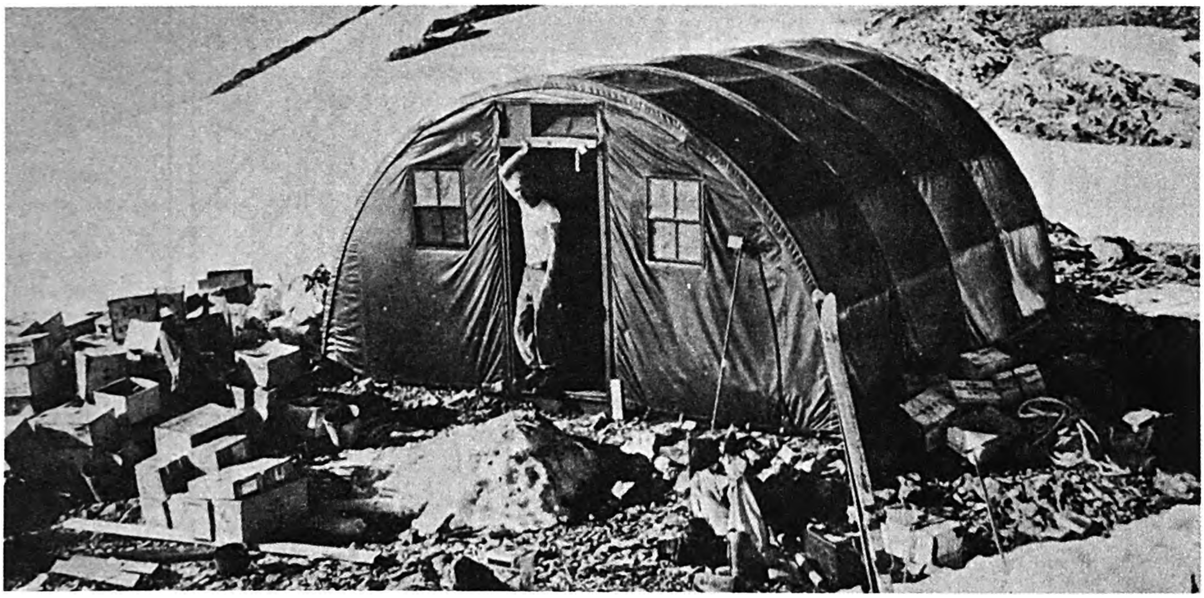

Figure 8c.--Jamesway Hut.

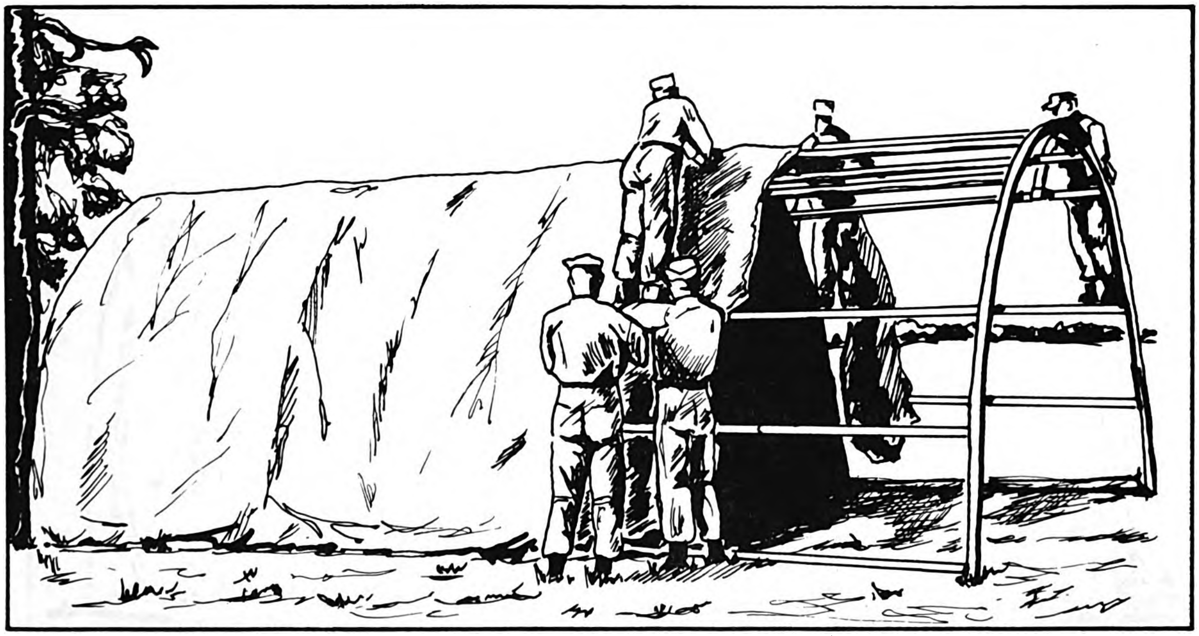

Figure 8d.--Shelter Extendible (Small).

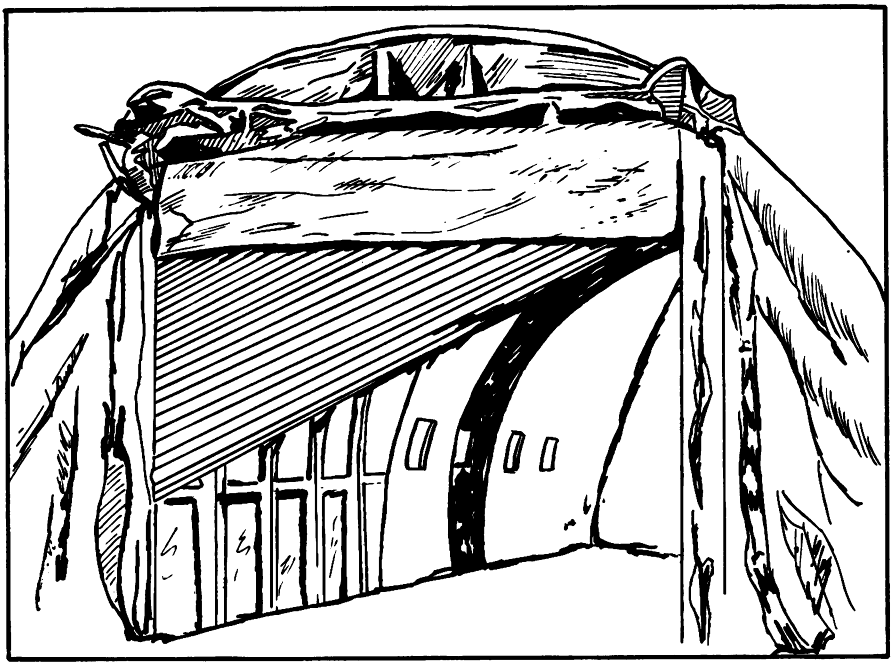

Figure 8e.--Shelter Extendible (Medium) Showing Inside.

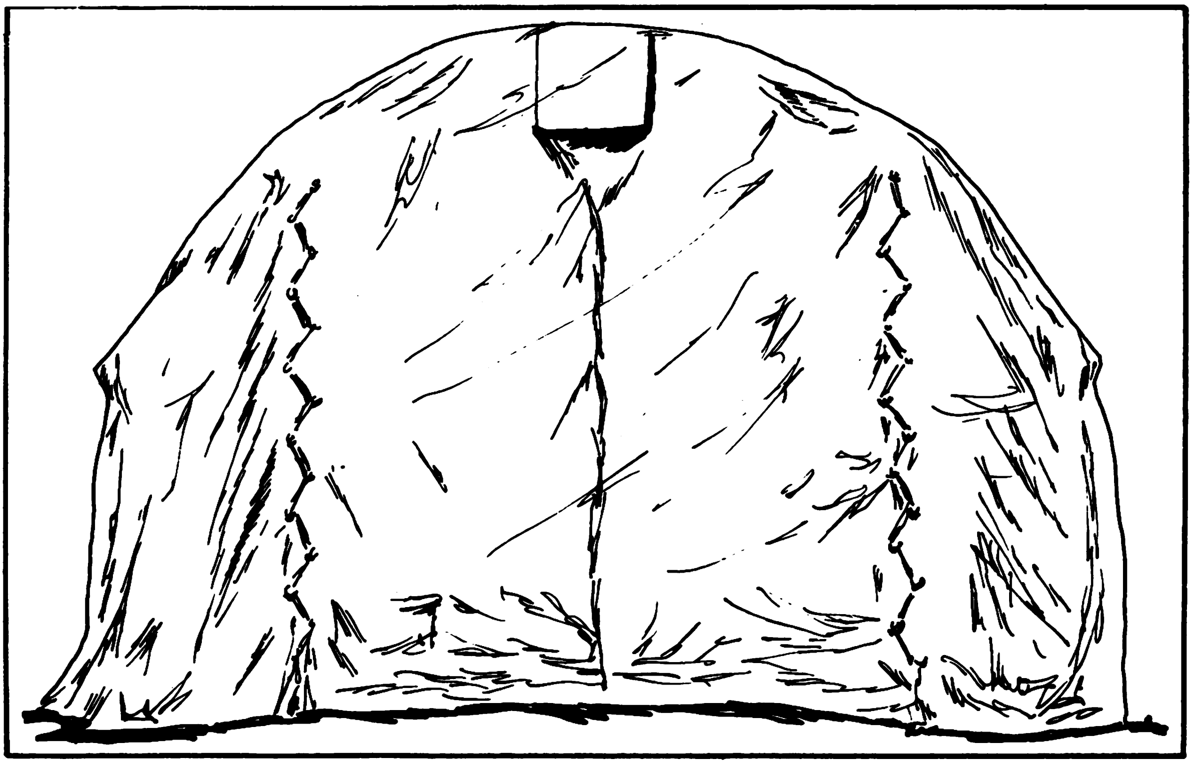

Figure 8f.--Shelter Extendible (Medium), Outside, Secured.

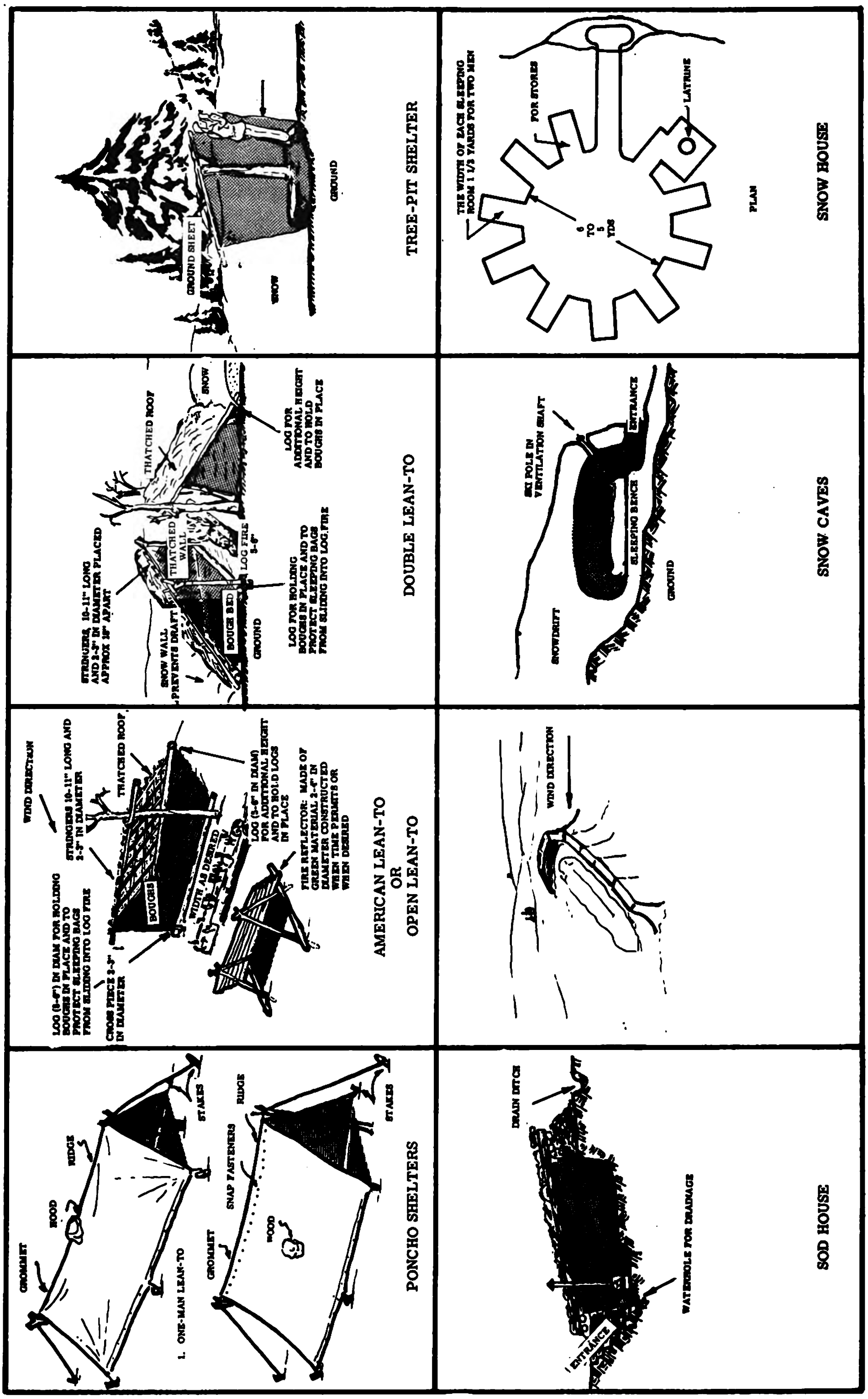

Figure 9.--Improvised Shelters.

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(2) Ten-Man Arctic Tent.--The six-sided, pyramidal tent, supported by a telescopic pole, normally accommodates 10 men and their individual clothing and equipment. It will accommodate additional men by leaving individual packs and equipment outside the tent overnight and by lowering the telescopic pole to spread the side walls to cover more ground surface. It may also function as a command post, aid station, or as a small storage tent. The tent has two doors; this permits tents to be joined together, with access from one to the other, when additional space is required. A snow cloth is attached to the bottom of the side walls for sealing the tent to the ground. This is accomplished by piling and packing snow on the snow cloth. If the tent is used in terrain where there is no snow, sod or other materials may be used to seal the bottom of the tent. Flexible plastic screen doors are provided and may be attached front and rear of the tent for protection against insects. The tent is ventilated by four built-in ventilators on opposite sides and near the peak of the tent. Four lines are provided for drying clothing and equipment. Total weight, to include the pins and tent pole, is 76 pounds. The tent is heated by an M1950 Yukon stove. (See fig. 8b.)

b. Huts/Shelters.--Other shelters available to the landing force include the Jamesway hut, the shelter extendible (small), and the shelter extendible (medium). (See figs. 8c, 8d, 8e, and 8f.)

(1) Jamesway Hut.--The Jamesway hut is normally used as a command post, small aid station, operations center, or supply facility. It may be used as a small maintenance hut.

(2) Shelter Extendible (Small).--The length of the shelter extendible (small) may be any multiple of 8 feet, but is most practical at 24 feet. The weight of a 24-foot shelter is about 450 pounds when equipped for cold weather. The skeleton of the shelter is made of aluminum and weighs 175 pounds. The shelter can be erected in cold weather by two men in 1½ hours. Two men can strike the shelter in about half this time.

(3) Shelter Extendible (Medium).--The shelter extendible (medium) is 14 feet high, 20 feet wide, and 40 feet long. While this shelter can be used for a number of things, it is particularly well suited for maintenance and storage facilities. The shelter accommodates an M48 tank, although there is not sufficient room to rotate the turret with the gun mounted. The shelter can be extended to any length, but is most effective at the 40-foot length. The shelter weighs 1,700 pounds and is readily adaptable to cold weather use. Caution should be observed when erecting this tent in areas where heavy snowfall is probable. The large exposed surface provides too extensive an area for snow concentration. When this occurs, the beams give way under the unusual weight and strain and the tent fabric tends to stretch out of shape or tear. It requires a large maintenance effort to keep this tent in proper condition.

c. Improvised Shelters.--During the execution of cold weather operations, there are occasions when tents or regular shelters are not available. Survival in cold weather operations then becomes dependent upon the individual Marine's ability to construct improvised shelters from his individual equipment and natural materials at hand. Shelters which may be constructed in such cases include poncho shelters, lean-tos, tree-pit shelters, sod houses, snow walls, snow houses, and snow caves. Examples of such shelters and basic construction procedures are illustrated in figure 9.

2205. CLOTHING AND EQUIPMENT

Extreme cold weather creates an immediate requirement for special clothing and equipment. Loads carried by individuals and units increase sharply from those carried in temperate zones. Additional weight reduces the vehicular and foot mobility of landing force units. The full field load, less individual weapon, ammunition, and protective mask may weigh as much as 95 pounds. To the degree feasible, part of this load is carried in unit vehicles or on sleds. One of the very first problems the commander faces in low temperatures is to decide what items of clothing and equipment his troops should wear or carry and what should be carried with the unit. Factors influencing his decision include weather, mission at hand, physical conditions of his men, and availability of transportation. Overdressing is avoided. During cross-country marches or when in the attack, individual loads are reduced to immediate, essential needs. Additional clothing and shelter are carried in unit vehicles or brought forward by helicopters for use when cross-country movement is completed.

a. Individual Issue.--The following equipment may be required for all individuals:

(1) Cold weather clothing (complete).

(2) Overwhite set.

(3) Sleeping bag, arctic (double bag).

(4) Mattress, pneumatic.

(5) Rucksack or other carrying device.

(6) Skis with ski poles or snowshoes.

b. Cold Weather Clothing.--Clothing for use in extreme cold must be light, easily manipulated, provide warmth and ventilation, and be waterproof. Several layers of lightweight clothing are warmer than one single layer of heavy clothing. This is due to the insulative effect of the dead airspaces between the layers. Current arctic clothing is designed on this principle and makes use of three basic layers: the inner, intermediate, and outer. In addition, separate arctic clothing is available for wear in cold-wet and cold-dry areas. To ensure that cold weather clothing sets are adequate to serve their intended purpose, they are inspected for completeness and defects prior to issue. The actual issue is closely supervised by officers and NCO's to ensure that each individual gets a complete set that is in good condition and properly sized. Thereafter, periodic spot inspections are made throughout the operation to ensure that clothing is being kept in good condition. Small stocks of critical cold weather clothing; i.e., gloves and boots, may have to be carried at the battalion level to provide for emergency replacement. Insofar as the individual Marine is concerned, the key to taking care of his clothing and keeping warm in extreme cold is the word COLD:

(1) Keep it Clean.

(2) Avoid Overheating.

(3) Wear it Loose in layers.

(4) Keep it Dry.

c. Skis and Snowshoes.--The decision to employ skis and/or snowshoes is determined well in advance of projected cold weather operations to ensure appropriate training. The details of such training programs are beyond the scope of this manual. For a more complete discussion, see FM 31-70, Basic Cold Weather Manual.

(1) The techniques of moving on snowshoes can be learned in a few hours. Snowshoe training is largely a process of developing proper stride and of continuous use to harden the feet and to condition the muscles.

(2) The number of Marines to be trained on skis depends on the snow and terrain conditions expected in the area of operation. Cross-country skiing over flat or gently rolling terrain is a fairly simple matter. Troops must be trained to a degree where they are able to move with confidence.

(3) For long-range patrol duties, special troops on skis should be capable of averaging 30 miles a day over rolling types of terrain. Personnel to be used for this type of duty are selected from those with previous skiing experience or who show special aptitude.

(4) The commander determines the ratio of skis and snowshoes within his unit. Deep snow provides excellent mobility for troops equipped with skis and properly trained in their use. Insufficient time for training may force the commander to select snowshoes at the cost of mobility. For example, the technique of skijoring (towing of troops on skis) cannot be employed by troops wearing snowshoes. Personnel whose duty requires them to ride in vehicles such as drivers and heavy weapons crews are best equipped with snowshoes. Mixing of snowshoes and skis within rifle units is encouraged; it gives the commander a better balanced force, along with increased mobility. This is not intended to preclude equipping certain personnel with skis who might be assigned missions such as flank patrol, reconnaissance, or messenger duty where a higher degree of mobility is desirable. For example, if a company is moving in column, it would be desirable to have the point and flanks on skis for added mobility. Once again, terrain and situation will dictate. The bear paw type snowshoe may be carried on the backs of troops on skis for use as circumstances arise.

2206. ORGANIZATIONAL MOBILITY

Survival in cold weather operations requires that landing force units be provided with a degree of mobility beyond that provided to the individual through skis and/or snowshoes. Roads are few or nonexistent in most areas of the north. Landing force units cannot be restricted to roads and combat support and service units require a mobility equal to that of the supported force. Providing a full cross-country mobility without road construction is an important consideration in planning cold weather operations. The speed, range, and flexibility of helicopters and aircraft assist in providing mobility to landing force units. However, air support in vast areas of the north is not likely to be available in sufficient quantity to provide the full support required. In addition, weather tends to limit air operations. Accordingly, landing force elements require sufficient ground transportation to operate independently of air assault support.

GROUND PRESSURE

Pounds Per Square Inch

M48A3 90mm Tank	11.8
M103A2 120mm Tank	13.15
8-Inch Howitzer (SP) M110	10.9
155mm Howitzer (SP) M109	10.9
175mm Gun (SP) M107	11.6
LVTP	8.2
LVTP Cmd	8.2
LVTR1A1	8.6
LVTE1 (Blade)	9.5
M116 Cargo Carrier, Amphibious	1.9 curb weight 2.6 w/3,000-pound load
M561 Truck, Cargo, 1¼-Ton 6x6	4.8-6.0
200-Pound Man on Skis	0.4
200-Pound Man on Foot	4.8

Figure 10.--Vehicle Ground Pressures.

a. Wheeled Vehicles.--Operations of wheeled vehicles are restricted in both winter and summer operations. To the degree feasible, they are replaced by tracked vehicles and/or sleds.

b. Tracked Vehicles.--The suitability of tracked vehicles for cold weather operations is dependent on ground pressure characteristics. A ground pressure of 2.5 pounds per square inch generally provides an over-snow capability. However, this is not sufficient for summer conditions. A ground pressure of 1.5 pounds per square inch or less allows a vehicle to operate in most overland conditions of the north on a year-round basis. Ground pressures of some existing tracked vehicles available to a landing force or in the testing stage are depicted in figure 10.

c. Man-Hauled Sleds.--Man-hauled sleds or akhios can carry a load of 100 to 200 pounds over difficult terrain and are used for carrying tents, stoves, fuel, rations, and other necessary items. (See fig. 11.) They may be used as a firing platform for machineguns and are particularly useful in the evacuation of casualties.

d. Cargo Sleds and Wanigans.--Cargo sleds are classified as light or heavy. Light sleds are under 5-ton payload capacity, and heavy sleds have a payload capacity in excess of 5 tons. A wanigan is a sled with a housing structure built on the bed of the sled or on a separate structure anchored securely to the bed. The operation of sleds is restricted by terrain and the capabilities of the prime mover. Light sleds are suitable for use when rapid travel is desired and in areas where the freezing season has mean temperatures which do not form more than moderate thicknesses of ice on rivers and lakes. The heavy sled is best suited for use over flat or gently rolling terrain and in areas where rivers and lakes are frozen to sufficient depths to permit their use as highways. Wanigans may be used for command posts, communication and radio shelters, kitchens, electrical generator shelters, sleeping quarters, aid stations, work shops, or storage facilities.

2207. PERSONAL HYGIENE AND SANITATION

Keeping the body clean in cold weather is not easy. The entire body should be washed at least weekly. If bathing facilities are not available,

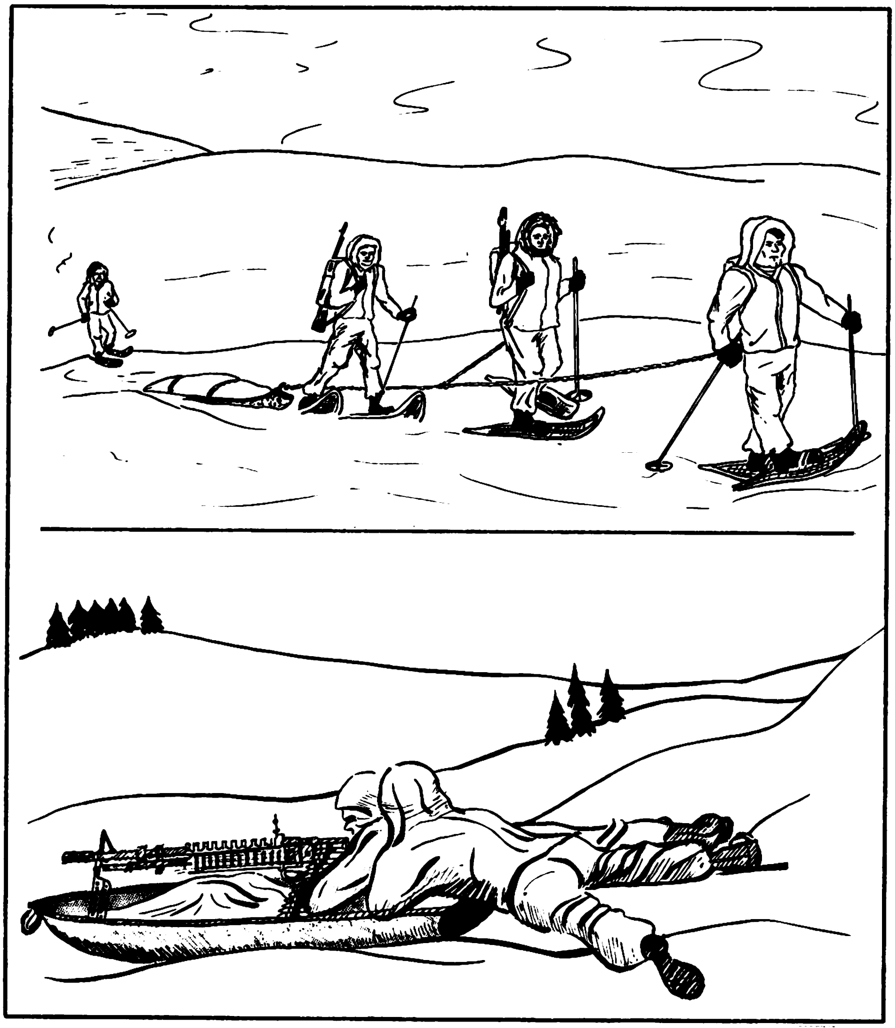


Figure 11.--Akhio Employed as Cargo Sled and Weapons Platform.

the entire body can be washed with the equivalent of two canteen cups of water, using half for soaping and washing and half for rinsing. If circumstances prevent use of water, a rubdown with a dry cloth will help. The feet, crotch, and armpits should be cleaned daily.

a. A temporary steam bath can be built in a large-size tent. (See fig. 12.) Cobblestones are piled up to form a furnace. The furnace is either heated inside the tent (ventilation flaps wide open) or in the open with the tent pitched over the furnace after the stones are heated. Wood is used for fuel. Seats and water buckets are taken into the tent after the stones are nearly red-hot and the fire has died down, so that they do not get sooty. The pouring and washing water is thrown on the hot stones in small quantities. Thus, it does not drop into the ashes and the temperature does not rise too fast. A naked person spends from 15 minutes to 1 hour in this steam bath. After thoroughly perspiring, the body is washed with tepid water.

Figure 12.--Temporary Steam Bath in Tent.

b. Beards are shaved or slipped close. Hair is combed daily and not allowed to grow too long. A beard or long hair adds very little in insulation value and soils clothing with the natural hair oils. In winter, a beard or a mustache is a nuisance since it serves as a base for the buildup of ice from moisture in the breath and masks the presence of frostbite. All individuals shave daily when possible. Under chemical or biological warfare conditions, a beardless face and daily shaving are especially important since an airtight seal of the protective mask is difficult to obtain with even stubble on the face.

c. Socks are changed and the feet washed daily. If this is not possible, the boots and socks are removed, and the feet massaged and dried. By sprinkling the feet liberally with foot powder and then rubbing the powder off, the feet can be efficiently dry cleaned.

d. Sleeping bags are kept clean. Liners are used. Subject to operational requirements, the best method is to wear only the minimum clothing in the bag and never get into it with damp clothes. Dry underwear is put on before going to sleep and the other set hung up to dry. Perspiration soils a sleeping bag and causes it to become damp. Therefore, bags are aired as frequently as possible. In the morning, the bags are opened wide, and air pumped in and out to remove the moist air within the bag.

e. Underwear and shirts are changed at least twice weekly. When it is not possible to wash the clothing this often, the clothing is crumpled, shaken out, and aired for about 2 hours.

2208. CAMOUFLAGE AND CONCEALMENT

Landing force elements are better able to survive in extreme cold weather when they can conceal their operations.

a. Observation.--From the air, snow-covered ground presents an irregular pattern of white, spotted with dark tones produced by objects protruding above the snow, and by irregularities in the snow surface such as valleys, hummocks, ruts, and tracks. To ensure concealment, it is necessary to site dark objects on dark backgrounds, control the making of tracks in the snow, and maintain the snow covering on installations so camouflaged.

b. Blending With Background.--No practical artificial material has been developed which reproduces the texture of snow sufficiently well to be

a protection against photographic observation. Concealment from direct observation is relatively successful through the use of white snow garments, white paint, and whitewash. However, these measures can be detected by aerial photography.

c. Concealment Practices.--Camouflage construction such as net frames must be strong enough to support the weight of heavy snow and the buffeting of heavy winds. Tracks are controlled. In snow, they show up as lines of dark shadows, and it is almost completely impossible to obliterate them by brushing or other means. Tracks are continued past installations to what appears to be a logical destination whenever possible. Nets may be used as drapes to catch the first snowfalls.

d. Notes on Snow Camouflage and Concealment

(1) The use of decoys as well as decoy tracks can be particularly effective in snow terrain.

(2) When tanks or other tracked vehicles turn quickly, small mounds of snow are piled up and reveal the nature of the vehicle. Such snow mounds are brushed out. If tanks turn slowly in a gradual arc, these snow mounds are not formed.

(3) A road grader may be used to obliterate tank tracks on ice or a hard, crusty road surface.

(4) Shine/glare is eliminated as in all camouflage attempts. Shine/glare is often the only revealing feature of an object in snow terrain.

(5) Full use is made of available cover in the parking of vehicles.

(6) Deciduous vegetation loses much of its concealing value in winter when the leaves have fallen. Such concealment is supplemented with drapes or screens when necessary.

(7) When white covers are not available, dark ones can be used if they can be covered with a layer of snow.

(8) Thawing conditions are advantageous to camouflage since they reveal dark patches and form a disruptive pattern.

(9) The degree of whiteness of artificial materials used for camouflage in snow terrain is carefully chosen. A hint of yellow or red betrays the camouflage. White with a blue tint is preferable.

e. Individual Camouflage

(1) Troops operating in open areas covered with snow wear a complete white camouflage suit. Ski equipment is painted white. Individual equipment and weapons are provided with white covers.

(2) Troops operating in wooded areas wear either white camouflage pants or a complete white camouflage suit, depending on the snow condition. (See fig. 13.)

Figure 13.--White Camouflaged Suit in Wooded Area.

f. Tent-Group Camouflage

(1) In open areas, the following methods are used:

(a) Arctic tents are dug into the snow and camouflaged by placing the white inner lining over the outside.

(b) Sleds are painted white and are kept in the snow. Tools, rations, and other items can be kept in sleds under white canvas covers.

(2) In wooded areas, tents are dug into the snow close to bushy trees whenever possible. The outline of a tent is broken by placing white camouflage on the tent. Sometimes in forested areas, a bough platform supported by the nearest trees can be built above the tent. This diverts the smoke coming from the stovepipe. Weapons and ski racks are located under bushy trees.

g. Camouflage of Vehicles

(1) In open areas, vehicles are whitewashed or equipped with white canvas covers. Vehicles are well dispersed and, when possible, kept off the road. When a bulldozer is available, pits can be dug into deep

snow for the vehicles. Gentle reverse slopes are suitable locations for vehicle pits. These pits can be covered with camouflage nets. Since there are no practical means for obliterating vehicle tracks, they are kept to an absolute minimum. Vehicles are best moved during darkness or a snowfall.

(2) In wooded areas, vehicles are mottle painted or partially covered by white canvas and/or covered with small trees or branches. In inhabited areas, the vehicles are located close to buildings or inside barns.

h. Camouflage of Defense Positions

(1) Placing positions on the topographical crest is avoided when the situation does not require it. Snowbanks, defilades, and lee sides of objects such as large boulders are utilized. Open mountain tops have very thin layers of snow. If time permits, this situation can be improved by placing snow fences which will collect snow in those places where positions have to be built. The trails to such positions are preplanned and limited in number.

(2) When building positions, high silhouette type structures such as igloos are avoided as they can be observed easily from a distance. When troops are digging foxholes or crew-served weapons' positions, they cover the spoil with fresh snow. All sharp edges and snowblocks around the position are smoothed down so that the position blends with the surrounding terrain. Communication ditches leading to crew-served weapons are covered when time permits.

(3) When the positions are completed, camouflage continues. Crew-served weapons are concealed with white canvas or camouflage nets, which can be partially lifted, allowing full freedom for the weapons to operate and cover assigned fields of fire. After each snowfall, when snow is shoveled out of the trenches and foxholes, a thin layer of snow is left in the bottom of the position to conceal the dark ground. Strict track and trail discipline is enforced at all times. Movement to positions on forward slopes is restricted, usually to hours of darkness.

2209. SURVIVAL PROCEDURES

When separated or lost, it is necessary for the individual Marine to provide for his own survival. Accordingly, it is advisable that a simple survival kit be made available. Figure 14 depicts a typical survival kit. In addition, all personnel are trained in the use of emergency signals and signal devices. Effective signalling devices include moving signal flags, smoke signals, and mirrors. Under good visibility conditions, such signals are effective at long distances. Signal flags are also effective in communicating with aircraft after the grounded party is sighted. Messages may be spelled out in the snow or on ice with stamped tracks or with sticks, rocks, and dye, employing the Ground-Air Emergency Code. (See fig. 15.)

2210. TRAINING PROGRAM

a. Training Objective.--The objective of cold weather training is to train individuals and units to accomplish their combat mission under all conditions of weather, climate, and terrain which may be encountered and to develop and stress leadership and individual initiative. Cold weather

SURVIVAL KIT CONTENTS

Signal mirror (or the shined top of a can).
Slingshot rubber (slingshot for small game).
Snare wire; trip wire (for small game).
Cord (for bow string or snare).
Nails (cut in half for use as spear points).
Steel file.
Needle and thread.
Harpoon or shark hook (tied to pole, makes good gaff).
Fish line and hooks (use one inch of dog-tag chain as lure).
Small compass.
Magnifying glass (for fire starting).
Cartridges (powder is good fire starter).
Wax candles (fire starter in rain or snow).
Razor blades.
Water purification tablets (for <u>all</u> water consumed).
Small knife.
Safety pins (as pins or fish hooks).
Matches (securely waterproof).
Bandage strips.
Ground-air emergency code).
Flint.
Rubber tube (for straw or slingshot).
Pencil
Hacksaw blade.

Figure 14.--Typical Individual Survival Kit.

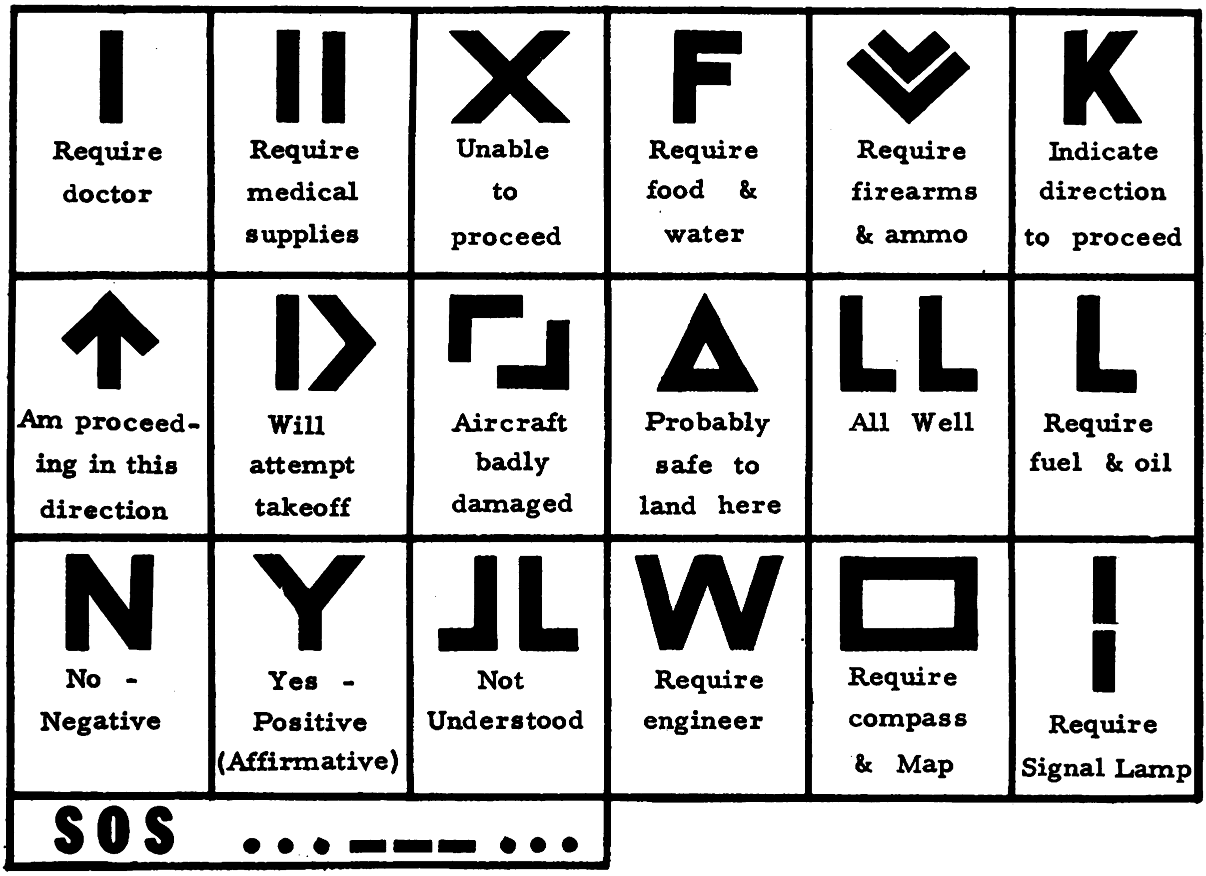


Figure 15.--Ground-Air Emergency Code.

training provides for toughness, resourcefulness, initiative, and the ability to live and operate effectively under adverse conditions. The requirements for instruction in various subjects should be analyzed to determine the desired performance expressed in terms of objectives for individuals and units. The course of instruction and the subjects required are then structured with a clear goal in mind. FM 31-71, Northern Operations, while oriented towards time requirements rather than objective oriented can provide some assistance in determining subject matter for training.

b. Conduct of Training.--One of the first problems to be solved after the landing force has received warning orders for deployment to a northern environment is to decide what type of training can be initiated immediately at the home station and what training should be done upon arrival in the special training area.

(1) Preliminary indoctrination training in many subjects can be taught anywhere and does not necessarily require the existence of the

COLD WEATHER TRAINING

(Subjects which do not require the presence of snow and cold.)

1. Physical conditioning.
2. Principles of cold weather clothing.
3. Prevention of cold injuries.
4. First aid and hygiene.
5. Care of weapons, instruments, and vehicles in extreme cold and snow.
6. Use of tents, stoves, and emergency shelters; bush craft and camp routine.
7. Snowshoeing.
8. Techniques in loading and lashing of sleds.
9. Techniques of dead reckoning.
10. Effects of nuclear weapons in cold and snow.
11. Winter mine warfare.
12. Geography and climate of northern latitudes.

Figure 16.--Subjects Which Do Not Require the Presence of Snow and Cold.

environmental factors--snow and cold. Thus, time may be gained for tactical and technical advanced training when these conditions become available. Subjects that do not require the presence of snow and cold are depicted in figure 16.

(2) Individual and unit training requiring the existence or the environmental factors is initiated immediately upon arrival of the landing force in the training area. Because of the special factors introduced by snow and extreme cold, individual and unit training in northern winter conditions differs considerably from that conducted in the temperate zone. In the first place, winter conditions require a high standard of physical stamina and fitness as well as psychological adjustment by all individuals of the unit. Also, many techniques such as skiing, skijoring, handling of weapons in deep snow, and trailbreaking must be learned. Some of the most important training subjects that require the presence of snow and cold are depicted in figure 17.

c. Instructor and Specialist Training.--Usually, very few individuals qualified as artic instructors are found within the elements of a landing

COLD WEATHER TRAINING

(Subjects which require the presence of snow and cold.)

1. Oversnow movement:

   a. Individual skiing and snowshoeing.

   b. Motorized and mechanized.

   c. Trailbreaking technique.

   d. Skijoring.

2. Field fortifications in snow and frozen ground.

3. Individual fighting techniques in snow.

4. Camouflage and concealment in snow.

5. Land navigation in the woods and tundra at night.

6. Weapons training and firing in extreme cold and deep snow.

7. Evacuation of casualties including sled, 200-pounds pulling.

8. Trailbreaking tactical aspects.

9. Construction of winter roads.

10. Long distance patrolling.

11. Unit training:

    a. Small unit problems.

    b. Battalion and task force problems.

12. Maintenance of vehicles, weapons, communication equipment, and tentage.

Figure 17.--Subjects Which Require the Presence of Snow and Cold.

force; therefore, efforts to obtain and train instructors should commence immediately when employment in cold weather environment is anticipated. Also, key specialists such as pilots, mechanics, engineer heavy equipment operators, radio operators, corpsmen, and even vehicle drivers require specialized training.

Section III. AMPHIBIOUS OPERATIONS

2301. GENERAL

Amphibious planning for operations in a cold weather environment conforms to the general principles delineated in LFM 01, Doctrine for Amphibious Operations, and LFM 02, Doctrine for Landing Forces. Such planning is normally of longer duration than that for similar operations in lower latitudes. A planning schedule is established at an early date, with deadlines for completion of the several parts of the plan. Logistic planning is completed early enough so that at least 90 days are allowed for the procurement of special supplies and equipment. Plans are based on detailed consideration of the cold weather environment and the influence it exerts upon projected operations of the amphibious task force and the landing force. To provide for unexpected changes in the weather, alternate plans for the ship-to-shore movement and for the scheme of maneuver ashore are prepared.

2302. OPERATION PLANNING CONSIDERATIONS

Major problems in planning the amphibious operation include the extremes of weather; adaption of existing ships and equipment to extreme cold weather conditions for which they were not initially designed; the maintenance of ship readiness and personnel efficiency in high latitudes; increased shipping requirements; and the development of realistic loading, embarkation, and operation plans.

a. Extremes of Weather.--Extremes of weather impose conditions on an amphibious task force which limit the amphibious assault against a defended beach in northern latitudes. At times, a landing on a lightly defended or undefended beach may be executed followed by an overland assault on the objective. Once ashore, the conduct of the operation is essentially the same as for any other attack in northern latitudes.

(1) Sea Ice.--Sea ice is the greatest single factor affecting amphibious operations at sea in cold weather operations. In any amphibious operation within sea ice areas, the commander amphibious task force requires considerable latitude in determining where and when to attack. Positive air protection of the ATF is required because it is extremely difficult to take evasive action. The force is normally accompanied by ice breakers and progress is slow. Amphibious operations requiring ships to enter an ice pack may have to be abandoned as impractical.

(2) Ice Free Areas.--Within ice free areas, no departure from standard amphibious operating procedures is required.

(3) Unnavigable Ice.--Unnavigable ice consists of pack ice or landfast ice fields that are either impenetrable or penetrable only by the largest and most powerful icebreakers. Under such conditions, one of two methods of landing may be used:

(a) Landing by helicopter may be feasible. In this case, the operation is limited tactically and logistically in accordance with the capabilities and limitations of the helicopters employed.

(b) In the event helicopters cannot be employed, the amphibious operation may be executed in conventional landing craft on the

edge of the icepack for subsequent movement against the objective. Under these circumstances, the operation is of a limited nature and against an undefended or lightly held enemy position, since only lightly armed, swift moving, highly trained personnel can be used. Logistic support is normally by air.

(4) Marginal Ice Areas.--Marginal ice areas include those areas that are negotiable by light icebreakers or specially reinforced ships, and areas free from pack ice but subject to drifting ice and scattered ice floes. This ice is continually moving because of the wind and ocean currents. If a landing is to be executed within the ice area, the commander amphibious task force determines when to attack, basing his decision on these ice conditions. Once the attack is initiated, speed in landing assault elements of the landing force and providing for their logistic support is of great importance. Logistic plans include an alternate plan for supply by air should ice conditions change during a critical part of the operation. Helicopters add flexibility when planning an amphibious assault under marginal ice conditions.

b. Ship and Equipment Requirements.--In planning for ships to be used in the operation, consideration is given to the need for large ships to hoist boats and to withdraw to a protected anchorage. Equipment and supplies necessary for the operation vary with the assigned mission. This chapter gives indications of possible requirements. Detailed planning is required to ensure that supplies and equipment are compatible with the specific operation being conducted.

c. Personnel Requirements.--Whenever practicable, personnel with experience in cold weather operations are assigned to planning staffs and to the operating forces of amphibious task forces preparing for cold weather operations. There is a particular need for medical officers familiar with cold weather operations. In planning personnel requirements for the particular mission assigned, needs during operations afloat and ashore are considered.

(1) Operations Afloat.--Amphibious operations under conditions of extreme cold require the frequent relief of crews (salvage boat, cargo transfer, or hospital boat). Boat groups are augmented by approximately one-third. Additional underwater demolition team (UDT) personnel are also required. For round-the-clock operations of amphibious vehicles, a 50 percent to 100 percent increase of normal personnel allowances may be required.

(2) Operations Ashore.--Additional personnel are required to support assault elements of the landing force. Engineer troops are assigned in at least twice the number required for an operation of the same size in a temperate climate. Augmentation to 300 percent may sometimes be required. Increases in communication personnel and maintenance personnel are also made since an increased maintenance workload is performed under extremely adverse conditions. Cold winds on the beach and the need to relieve outside workers frequently necessitates augmentation of almost all components of the shore party. Beachmaster units are normally increased by at least 50 percent and the number of heavy equipment operators is doubled.

(3) Personnel Loading.--In planning personnel loading, careful consideration is given to the number of troops assigned to individual ships. The large amount of personal equipment carried by each individual embarked

requires that normal personnel loading numbers be reduced. The degree of reduction varies and is normally greatest on the smallest ships. Reduction in troop loading may be as high as 25 percent, however, even for large ships.

2303. LOGISTIC PLANNING CONSIDERATIONS

Logistic preparations for a cold weather operation are not limited to planning for below freezing temperatures. Landing force units are appropriately equipped and outfitted to function in the winter and/or summer environment. Detailed logistic planning is required to isolate requirements and procure the means required to facilitate an orderly exchange of equipment during seasonal transitions. It is important to note that current tables of organization for combat service support forces are not designed for arctic operations. This factor is taken into consideration in estimating requirements.

2304. PREPARATIONS PRIOR TO LANDING

There is always an element of danger to any amphibious task force that must enter an area of pack ice. Even when accompanied by an adequate number of icebreakers, progress is slow and evasive action difficult. Amphibious operations in which ships are required to meet such danger may conceivably be beyond the level of calculated risk. Accordingly, the final decision as to whether the mission can be accomplished is made very late. Sufficient flexibility is provided in plans to permit changing the time, location, and manner of attack specified in the original plan in order to cope with sudden changes in the operational environment. Numerous difficulties may be met while the force is prepared to land. Preparations require a longer period than for operations in temperate regions. Troop assignments are made early and with due consideration of special cold weather problems.

2305. PREPARATION OF THE OBJECTIVE AREA

Preparation of the objective area includes minesweeping, amphibious reconnaissance, UDT operations, naval gunfire support, and air support.

a. Minesweeping-- Jagged and pinnacled bottoms off high latitude coastlines necessitate carefully executed minesweeping operations.

b. Amphibious Reconnaissance.--Landing of reconnaissance elements from submarines to determine the location and strength of enemy defenses and to support the beach assault may return dividends.

c. Naval Gunfire and Air Support.--Pre-D-day naval gunfire preparations of the objective area may encounter difficulties. The subarctic operation moves slowly both on and off the beaches. Consequently, a longer time is allocated for preparation of the objective area. In addition, inclement weather may limit air operations and accurate naval gunfire to relatively short periods. Sectors of responsibility may prove difficult to determine because of insufficient landmarks or the presence of snow. Targets located in unfrozen tundra, muskey, or heavy snow require greater concentrations of fire for destruction than do other targets, since bursts are cushioned and the effective area reduced. The time required for preparation depends not only on weather conditions but also ln the type of landing to

be made; i.e., whether landing is by helicopter, amphibious vehicles, LCVP's, or larger landing craft/ships.

2306. DISPOSITION OF TROOPS

During the movement to the objective area, ships are not loaded to full capacity. It is normally desirable to eliminate a personnel transfer line by transferring troops from LPA's to LST's in a sheltered harbor prior to the landing. Another method is to transfer personnel in the outer transport area in sufficient time to be ready for H-hour. Since troops are encumbered with extra gear and clothing, this method is less desirable.

2307. ASSAULT LANDING

a. General.--The actual assault landing is based on weather and beach conditions and the amount of hostile opposition anticipated. Alternate landing plans are prepared. Consideration is given to the selection of a nearby protected anchorage into which small craft or even the entire attack force can be deployed in case of heavy weather while an operation is in progress.

(1) Speed in the execution of the landing is of great importance because of the frequent storms in cold areas. Coxswains and/or vehicle commanders are especially trained in handling landing craft or vehicles and in precautions to take in case of a sudden storm. A rehearsal of the landing is normally conducted in a locality where weather conditions are similar to those in the objective area. Both the preferred and the alternate landing plans are rehearsed.

(2) If weather conditions permit, unloading is on a 24-hour schedule. This requires additional crews for boats, LVT's, etc.

(3) Debarkation is scheduled so as to keep personnel in landing craft the shortest time possible. When cargo nets are used for debarkation, it is essential that there be no ice on them. Deck areas and debarkation areas must also be free of ice. Use of nets for personnel requires that lowering lines and cargo nets also be used for lowering individual equipment and weapons. Under difficult conditions, packs are lowered in cargo nets to increase the speed of debarkation. Individuals in ship's platoons are relieved frequently so that unloading continues at a uniformly high rate.

(4) During the beach assault, every effort is made to secure a dry ramp landing. Troops and crews of landing craft are protected against sea spray during the ship-to-shore movement. Operation of all mechanized equipment is difficult. Provisions are made for freeing landing craft ramps should they freeze during the movement ashore. It is probable that amphibious vehicles will be used exclusively for the movement of both troops and supplies ashore because of sea ice and beach conditions. The conventional LCVP and LVT landing is suitable in certain weather conditions. Landings with only LST's, LCM's, and LCU's are suitable in less favorable weather.

b. Use of Pontoon Causeways and Ferries.--The necessity for dry landings increases the desirability of using pontoon causeways and pontoon ferries for unloading. Causeways on exposed beaches are in danger from sudden arctic storms.

c. Use of Large Cargo Trailers.--The use of large cargo trailers in conjunction with LCM's ensures a high speed beach clearance rate for the landing of supplies and equipment. With a tractor, a loaded cargo trailer can be quickly removed from the LCM and delivered to dumps. With sufficient trailers available to place an empty trailer in each LCM immediately, a very rapid LCM turnaround time can be obtained.

d. Methods of Transferring Cargo.--In transferring cargo, special antiweather precautions are taken, relief crews assigned, and adequate fuel and spare parts provided for cranes. Communication equipment is provided for the establishment of a radio net between the landing force TAC-LOG control officer and each ship used in the transfer operation. It is also essential that adequate material handling equipment be available at the dumps for the unloading of bulk cargo.

2308. OFFENSIVE ACTIONS BY THE LANDING FORCE ASHORE

Once the landing force has developed its full combat power ashore in a cold weather environment, its operations are compatible with the tactical principles delineated in FMFM 6-1, Marine Division; FMFM 6-2, Marine Infantry Regiment; and FMFM 6-3, Marine Infantry Battalion. The best objectives are often enemy lines of communication. Severe winter weather hastens enemy destruction after his supply lines are cut. During winter, the most rearward breach in enemy lines of communication is normally made in the vicnity of dominating terrain so that landing force units making the breach can better prevent the enemy from reopening the route to his rear. During summer operations, objectives are selected where the line of communication crosses a river or passes between two lakes, particularly if the lakes are close together. This reduces the amount of ground to be held by the breaching force. In addition to objectives which cut enemy lines of communication, attacks are directed against enemy artillery positions and on enemy troops. Other objectives may be enemy airfields, weather stations, important railroad junctions, and supply installations.

a. Main Attack.--Main attacks are usually directed against the enemy's flanks while supporting attacks are directed against the enemy front to hold him in position. An additional force may be employed to bypass the enemy position and cut enemy routes of reinforcement or withdrawal. It is often advantageous to have them attack enemy flanks from opposite directions but converge on the same objective. The most mobile troops are used to breach the enemy's lines of communication. Once the main attack force executes the breach behind the enemy force, it then begins its attack on the enemy rear.

b. Assembly Areas.--Assembly areas are selected to provide security from enemy reconnaissance. When practicable, units move continuously from assembly areas to the line of departure and launch the attack. Attack positions, when necessary, are usually selected by company commanders. It may be necessary to employ trailbreaking parties in advance of the companies for the movement to the attack position.

c. Line of Departure.--In addition to normal requirements, the line of departure for all attacks should be selected so as to reduce as much as possible the length of time of exposure; i.e., as close to the enemy as possible.

d. Control Measures.--Axes of advance are frequently used as control measures. Boundaries may be used if close lateral control is necessary

and terrain permits designating discernible boundaries. In barren, flat terrain, an azimuth may be used to indicate the axis of advance. Intermediate objectives are assigned as necessary to control the attack and seize critical terrain.

e. Coordination.--Coordination is extremely important in cold weather operations. Communications are maintained on more than one channel and airborne retransmission is used when necessary.

f. Attack of an Organized Position.--Commanders inform their staff as early as possible of plans for the attack. This applies in particular to the logistics officer whose arrangements for logistic support are normally time-consuming.

(1) Reconnaissance is initiated early on a wide front to determine enemy locations and to reconnoiter routes and terrain.

(2) Attacks by aircraft and artillery are initiated immediately.

(3) The main body is screened from enemy reconnaissance with particular attention paid to the flanks.

(4) Fires of supporting artillery and mortars are closely coordinated. Representatives of supporting artillery are included in infantry reconnaissance patrols and in combat patrols. Preparation of firing positions for supporting weapons is begun early because it is time-consuming.

(5) Engineers with the force open new roads as necessary and/or repair existing roads or trails. Some engineer reconnaissance may be included in infantry reconnaissance patrols. In summer operations, bridging equipment and materials are moved well forward to be ready for use when needed.

(6) The communication plan is made in detail and provides measures for overcoming difficulties of construction and maintenance. Special attention is paid during summer to means for constructing wire lines over lakes and rivers.

(7) Supply reserves are kept mobile when possible. It may be necessary to establish base camps and/or distributing points in forward areas.

g. Preparation for the Attack.--When reconnaissance is completed and preliminary measures taken for the attack, trails are opened to assembly areas. When the distance is not too great, these trails are not opened until the day before assault units plan to move to assembly areas. Wire communications are laid simultaneously with breaking of trails and road-making. Movement to assembly areas is executed the night before the attack unless conditions of visibility permit daytime movement. Guides are provided.

h. Movement to Line of Departure.--A halt is made in the assembly areas and local security established only long enough to feed and otherwise prepare troops. All vehicles are dispersed and artillery is moved to previously prepared positions and camouflaged or concealed. Assault elements remain in the assembly area for the minimum length of time necessary to prepare for the attack. Following this preparation, units move toward

the line of departure in separate columns. Supporting weapons are moved to selected firing positions. Special assault squads are readied to destroy stronger fortifications. Tanks move into firing positions.

i. Conduct of the Attack

(1) The assault is made as in normal attacks. The line of departure is generally closer to the enemy under winter conditions than during summer.

(2) In continuing the attack, special efforts are directed toward moving heavy weapons forward rapidly. Some difficulty may be experienced in moving them forward in deep snow. Efforts are also directed toward maintaining a constant flow of ammunition. Continuity of the attack is preserved by rotation of units in the line to warming shelters. Tents are moved to the closest available covered and concealed area by each unit responsible. Supply routes are prepared as far forward as possible.

(3) The relief of committed units is executed as under normal conditions, with consideration given to rapid relief of assault elements so as to bring them back to warm shelter.

j. Pursuit.--The direct pressure force is aided by oversnow vehicles and tanks. The encircling force requires a high degree of mobility, employs oversnow vehicles or helicopters, and is lightly equipped. Tanks may be used to carry infantry. Aircraft constantly harass the retreating enemy. During summer, waterways may be used by the pursuing force as a means of moving patrols behind the enemy to destroy bridges and erect roadblocks along the enemy line of retreat.

k. Security in the Attack.--When attacking units have gaps between them, their flanks are vulnerable. These gaps require continuous surveillance by radar, patrols, etc. Any suspicious trail or activity is checked and reported to the neighboring unit as soon as possible. Roads, routes, and trails leading from the enemy position to the flanks of landing force elements are kept under surveillance. Some routes may be blocked by abatis or mines and covered by fire. Watch is kept for enemy air activity on the flanks of the attacking force. Air observers are alerted to look for signs of the enemy. Camp fires or ski trails may give away enemy positions. Requests are made for both day and night air observation missions to detect enemy troop movements and activities in enemy rear areas.

2309. DEFENSIVE ACTIONS BY THE LANDING FORCES

The defense is assumed in winter warfare for the same reasons as under normal conditions. However, some winter phenomena such as breakup or freezeup seasons, severe snow storms, or excessively low temperatures may compel landing force units to assume defensive positions. The defense may be assumed deliberately to force the enemy to attack under unfavorable conditions, such as in long, narrow passes or through deep snow and obstacles, where movement is made difficult for the attacker and his firepower is less effective. Enemy troops are forced to fight under the exhausting conditions of extreme cold while the defender occupies better shelter and shortens his supply lines.

a. Organization of the Defense.--In the northern latitudes, the defense usually is concentrated in a relatively small area. Examples of

this are airfields, settlements, or important road junctions. Such concentrations make a likely target for enemy nuclear weapons, and defense against such attack is required. Defensive fronts are relatively narrow and susceptible to envelopment by an enemy with good oversnow mobility. Under these conditions, a perimeter type of defense is most effective.

(1) In addition to normal security measures employed in the defense, a warning system is provided for the defensive position by establishing outer perimeter ski trails. These security trails are patrolled by detachments. Reconnaissance and combat patrols cross these trails only at designated places. Thus, enemy troops may reveal their presence by tracks crossing the security trails.

(2) In the logistic support area, plans and preparations are made to repel raids of enemy ground and airborne troops. Mobile security patrols are formed and an air warning system established. Special attention is paid to possible landing areas such as frozen lakes or rivers. When necessary, escorts are provided for supply columns by combat units, or air supply is used.

b. Selection of Defense Positions.--Strongpoints are located in terrain where the enemy is forced to attack through deep snow and, if possible, up a slope. The value of elevated defensive positions is greater during winter than under normal conditions. To reach them, the enemy must abandon skis. Further, tanks experience greater difficulty negotiating snow covered slopes. The launching of counterattacks by the defense is facilitated as they can be carried out downhill. Defensive positions located in deep snow suffer less from the effects of enemy fire. Frozen rivers and lakes provide excellent fields of fire. Deep snow conceals many ground forms thereby reducing the protection of attacking enemy troops. Natural obstructions such as dense forests, thickets, and cliffs collect snow and create obstacles to the attacker. Snow-covered rocks and fallen trees become tank obstacles.

c. Security.--When open flanks are secured by outposts, a system of contact patrols is set up between outposts. The time of patrolling is changed frequently. Usually two or three tracks are made between outposts.

d. Field Fortifications.--Hastily made firing positions and trenches are built in the snow and reinforced with readily procurable material such as ice, wood, or branches. A minimum of 6½ feet of solidly packed snow is required for adequate protection from small arms fire. When possible, positions are dug into the ground. Special tools and explosives are required for this purpose. Shelter is built simultaneously with the construction of positions. If the defense is to be of long duration, heated dugouts are used in place of tents. Medical aid stations and command posts are also located in heated underground shelters for protection from enemy fire.

(1) Tents are often used in temporary defense positions to shelter the men. They must be close to the combat positions and should be in defilade. The tents must be dug into the deep snow, or even into the ground, in order to protect the men against enemy fire. The tent rope must be well anchored by using deadman anchors or upright poles placed deep in packed snow. Immediately outside the tent, defense positions must be dug for use in case of sudden alert.

(2) Using explosives is the easiest and fastest way to break the frozen ground. However, the use of demolitions will be restricted

when under enemy observation. TNT is the best type of explosive for this purpose because it is less sensitive to the effects of cold weather. Dig a hole in the ground big enough to place the TNT charge, place the cap and fuze into the charge, cover it well, and detonate. By using electric caps and electric circuits, several holes can be blasted simultaneously. For an individual foxhole, 10 pounds of TNT will normally be sufficient. Another proven formula is to put two 1-pound blocks of TNT for every foot of penetration in frozen ground.

(3) Weak spots in the defense, where there is little snow or which are easily traversed by the enemy, are reinforced with artificial barriers such as wire entanglements, pitfalls, abatis, antitank mines, and antipersonnel mines. Digging positions in soft or hard snow is relatively easy and quick. In a static position, every effort must be made to improve the position and, if time permits, to dig it into the frozen ground. A position in the snow is only temporary and cannot withstand artillery and continuous small arms fire. Communication wires in forward areas are also dug in. Low ground in front of the defense position can sometimes be flooded by construction of a simple dam.

(4) Every effort must be made toward improvement of positions; snow blocks, ice blocks, sandbags, logs, and branches can be used to strengthen them. In addition, water may be poured onto the snow to form ice. In static positions, when time allows, water mixed with dirt, sand, or gravel can be poured into wooden forms. This is called "icecrete." The icecrete must be well tamped as it is poured to make it compact. Icecrete is darker than ice and will absorb more heat from the rays of the sun, causing melting. Icecrete construction must therefore be covered with snow, both to overcome its melting and to camouflage its contrasting color. Icecrete is much stronger than ice, provides considerable protection from small arms fire and shell fragments, and is a useful material for preparation of defensive positions.

(5) A rifle bullet rapidly loses its killing power depending on the density of the snow. Snow packed in layers tends to deflect the bullet at each new layer. Loose snow spread over a defense position will help smother ricochets. The minimum thickness for protection from rifle bullets and shell fragments is shown in the following:

Snow Wall Material*	Minimum Thickness in Feet
Newly fallen snow	13
Firmly frozen snow	8 to 10
Packed snow	6½
Frozen snow-water mixture	4 to 5
Ice	3¼
Icecrete	1

*These materials will disintegrate under sustained fire.

e. Firing Positions.--After snowfalls, trenches and fields of fire are cleared of snow. Dummy positions may be used extensively to mislead both ground and air observation. Road and trail networks are coordinated with the plan of defense. Care is taken to provide maximum concealment of all routes, especially those to gun positions in forward areas. Seasonal changes affect defense positions. The breakup season usually destroys positions built during the winter and fills low spots with water. During

the breakup season, special attention is paid to drainage of trenches and shelters. Positions or obstacles built during the summer may be made useless by heavy snow because of changes in elevation in the firing area or by covering the position entirely. When firing in snow, it is necessary that a firm support be used, as snow will compact. On hard packed snow, a weapon may slide. Therefore, any item available in the area or in the men's possession should be used to ensure a solid base; e.g., branches, skis, or sleds.

f. Composition and Location of Reserves.--An aggressive defense requires the formation of a large reserve with maximum oversnow mobility. Less mobile reserves are stationed closer to defensive positions than normal, while those on skis may be stationed farther away. In selecting a location for the reserve, consideration is given to the importance of rest, as well as to the probable area of employment. The major portion of the reserve is placed beyond the reach of enemy light artillery fire, in good shelters, while the remainder may be placed closer to the frontlines. Trails and roads to the probable points of action are prepared for the reserve and are kept open during snowstorms.

g. Conduct of the Defense.--Conduct of the defense under northern conditions is the same as under other conditions. Skis, oversnow vehicles, or helicopters may be used to make the reserve mobile.

h. Battle Preparedness.--Special attention is directed toward maintaining battle preparedness in winter warfare. While resting at the frontlines, men sleep fully prepared for combat. Constant care is taken to ensure that all weapons are prepared for immediate action. Firing positions and trenches are kept clear of snow day and night. Guards and patrols are increased if necessary and are inspected frequently.

2310. RETROGRADE MOVEMENT

a. General.--Retrograde movements are executed as in normal operations. In the north, suitable conditions are frequently present for leaving strong combat patrols to ambush the advancing enemy. Surprise attacks can be launched against columns of vehicles and troops at natural defiles. In some cases, it may be desirable to establish hidden caches of food and ammunition, prior to withdrawal, for the use of troops left behind to ambush the enemy.

b. Withdrawals.--Withdrawals are best accomplished under cover of darkness. If a daylight withdrawal becomes necessary, smoke may be used to good effect. Withdrawals are complicated by the necessity for providing shelter and heat for troops. Withdrawing forces are protected by both air and ground covering forces. Oversnow mobility is exploited to the maximum. During the withdrawal, troops destroy all abandoned shelters. Maximum use is made of mines, boobytraps, and abatis.

2311. ICE-CROSSING TECHNIQUES

Ice crossings pose serious problems to landing force elements. Routes across lakes and particularly over streams with strong currents are selected only after intensive and detailed reconnaissance of ice conditions. This reconnaissance is primarily concerned with determining the ability of ice to support the heaviest load that it must bear. The strength of ice is dependent on its structure, thickness, temperature, and underlying support.

Load Type	Gross Weight (tons)	Minimum Ice Thickness (cm/in)	Minimum Distance Between Loads (m/yd)
Marine on skis or snowshoes	0.1	3/1.2	5/5.5
Marine on foot	0.1	5/2	5/5.5
Infantry (column of 2)	---	7.6/3	7.3/8
Infantry (column of 4)	---	10/4	10/11
Wheeled vehicle loads up to:	3.5	23/9	15/16.5
Wheeled vehicle loads up to:	6	30/13	20/22
Wheeled vehicle loads up to:	10	40/16	25.6/28
Wheeled vehicle loads up to:	15	61/24	30/33
Tracked vehicle loads up to:	3.5	20/8	15/16.5
Tracked vehicle loads up to:	10	30/12	20/22
Tracked vehicle loads up to:	12.5	40/16	25.6/28
Tracked vehicle loads up to:	25	61/24	40/44
Tracked vehicle loads up to:	45	71/28	50/55
Tracked vehicle loads up to:	60	81/32	60/66

Figure 18.--Ice Load Bearing Capacities.

a. Load Bearing Capacity.--The load bearing capacities of fresh water ice are depicted in figure 18.

b. Expedient Measures.--For a safe crossing, ice can be reinforced by the following field expedients:

(1) Placing layers of snow on the surface of the ice and pouring on water to freeze the snow.

(2) Placing and freezing several layers of boughs, brush, or straw (each about 5 to 10 centimeters thick) to the ice surface.

(3) Placing boards, planks, and small logs to form tracks or runways for vehicles.

(4) Constructing corduroy roads over thin ice.

2312. EMPLOYMENT OF HELICOPTERS

Helicopter operations in an extreme cold weather environment are conducted in accordance with the general principles delineated in FMFM 3-3, Helicopterborne Operations. Such principles are modified as necessary to cope with extremes of the environment. Specifically:

a. Helicopters require special shelters and equipment for maintenance.

b. Helicopters usually have an increased lift capability in cold weather, subject to the maximum rated lift capability of the aircraft.

c. When snow covers the terrain, navigation may be based on limited use of landmarks such as lakes and prominent mountain formations or

electronic aids. Magnetic compasses are often useless in maintaining course because of the inadequate horizontal magnetic fields in high latitudes and the rapidly changing variation. Colored panels are used to mark landing sites and care is taken to ensure that panels are not covered by snow.

d. Severe cold complicates helicopter maintenance and supply. Special shelters are required and engines require an external source of power and heat. Engine operations may be hampered by improper fuel vaporization and icing. The necessity for removing frost from aircraft surfaces, prior to takeoff, may slow down flight operations. Wheels not kept on dry surfaces may freeze in place.

e. Cargo handling operations in extreme cold or snow are difficult because of problems produced in the hoisting and handling of external cargo. Hazards are caused by the buildup of static electricity charges on the hoist, the detrimental effects of cold rotor blast on ground personnel, and the blinding effect of blowing snow.

2313. TACTICAL AIR OPERATION

The success of landing force operations in a cold weather environment depends to a great extent upon support provided by tactical air operations. Large-scale, cold weather air operations are feasible with properly trained, supplied, and equipped personnel. Such operations conform to the general tactical principles delineated in FMFM 5-1, Marine Aviation.

a. The uncertainty of electronic communications used in air surveillance and tactical control of aircraft may, on occasion, restrict tactical air operations.

b. Both tactical and strategic bombing are more effective when using a larger percentage of incendiary bombs than high-explosive bombs. Shelter is an absolute necessity to sustain life in the Arctic and becomes a primary target for air attack.

c. The foremost limitations and problems of the tactical control system in northern areas are:

(1) Terrain features and weather conditions make the siting of radar sets difficult.

(2) Great distances involved require the erection of a farflung air surveillance and control system. The distances and lack of roads hamper the supply and maintenance of outlying radar locations.

(3) Unstable atmospheric conditions frequently disrupt radio and long-distance wire facilities.

d. Once aircraft are airborne in northern areas, tactical air support operations are actually much easier to accomplish from the pilot's standpoint. Most ground operations in the Arctic take place over snow-covered terrain, where any movement leaves a telltale track. Bivouac areas, supply dumps, fortified positions, and road nets have vehicle tracks or ski and snowshoe trails leading directly to them, which simplify the problems of fighter-bomber and reconnaissance pilots.

2314. EMPLOYMENT OF ARTILLERY

a. General.--Employment of artillery in cold weather operations is compatible with the general principles delineated in FMFM 7-4, Field Artillery Support. Such principles are modified as necessary to cope with the problems presented by the cold weather environment. Artillery fire is affected by the lack of accurate maps and by difficult conditions for observation. Position areas are carefully reconnoitered to preclude bogging down in deep snow or becoming stuck in muskeg. Local defense is a serious problem because the open terrain makes positions more vulnerable to enemy observation, attack, and fire. Ice fog, caused by firing of weapons, operation of vehicles, and personal stoves, reveals positions and limits observation. Severe cold adversely affects weapons seals and the recoil of weapons, and it hampers the activities of gun crews. Meteorological data changes with rapid changes of temperature and density. Since maps may be poor or unavailable, registration is difficult. In many instances, aircraft may be used for spotting and adjusting fires, reconnaissance, locating friendly troops, marking targets for airstrikes, air delivery of supplies and messages, and as multichannel radio or control in the artillery radio net. Ground fog, haze, and brilliant snow make adjustment difficult.

(1) Observers must be equally as qualified as the infantrymen to move in prevailing conditions. Cannoneers wear their arctic clothing to prevent frostbite and frozen extremities of the body. While wearing the cumbersome arctic mitten set, the cannoneer finds it difficult to open fuze containers and prepare rounds, because his manual dexterity and sensitivity are severely reduced. The frequent rotation of troops from gun positions and observation posts to warmup tents is necessary during extreme cold.

(2) Observer parties may be positioned in tracked vehicles. Checkpoints, known locations, and appropriate terrain features are few and observers must use initiative and ingenuity. Extensive use of air observation is required. The air observer forwards information on deep targets and observes all fire missions beyond the range of ground observers. In some instances, the attention of ground observers can be quickly directed to targets located by air observation. Helicopters are used by elements of the landing force to gather additional information concerning the enemy. Target restitution from aerial photographs is a highly accurate method of locating targets in arctic regions. Photo inspection is of great value in selecting routes and future positions. A physical reconnaissance is necessary to determine the capability of the terrain to support artillery traffic.

b. Ammunition and Weapons.--Behavior of propellants for artillery weapons at low temperatures is not consistent. In addition, increased amounts of carbon are generated by the burning of propellants at low temperatures; this results in increased maintenance problems. When ammunition containers are opened to remove projectiles and propellants, the adhesive-backed, cloth sealing tape breaks and is difficult to remove. In storage, the cloth facing separates from the adhesive at temperatures below 0 degrees Fahrenheit. At temperatures below minus 25 degrees Fahrenheit, approximately 90 percent failure of this tape occurs.

(1) Fuzes.--Dud rates for point detonating fuzes are excessively high at low temperatures. Proximity fuzes (VT fuzes) do not perform effectively at low temperatures (below minus 20 degrees Fahrenheit) and must be kept in warm storage. Under field conditions, this is difficult

and often impossible. VT fuzes are designed for use at temperatures between 0 degrees Fahrenheit and plus 120 degrees Fahrenheit and are stored at temperatures between minus 20 degrees Fahrenheit and plus 130 degrees Fahrenheit. If these fuzes are fired outside these temperature ranges, their performance may be severely limited, although firing safety is not affected. An air burst with either a variable time (VT) or mechanical time fuze is most effective against personnel in the open.

(2) Storage.--For most effective performance, ammunition is placed on dunnage during storage. Ammunition is kept free of ice and snow. Container components must remain closed during temperature conditioning to prevent condensation. Only the ammunition required for a mission is unpacked.

(3) Fragmentation.--The distribution of fragments is greatly reduced when shells are detonated under snow. There may be a smothering factor as high as 80 percent when shells are detonated under only 4 inches of snow. The phosphorous shell produces the desired smoke, but it leaves phosphorous particles buried in the snow. These may remain as a possible hazard for several days.

c. Weapons.--Artillery weapons are adversely affected by low temperatures. Maintenance of the weapons becomes a major problem. Care is taken in assembly and disassembly to prevent the parts from freezing, which would make reassembly impossible. Seals are replaced with unusual frequency, because of leakage caused by extreme cold and changing temperatures. On pieces using separate-loading ammunition, the breach is swabbed between rounds with solvent instead of water. Equilibrators are carefully exercised during extreme cold. The turning of handwheels requires more effort. Recoil systems may fail to return the piece to battery after prolonged exposure in temperatures from minus 40 degrees to minus 68 degrees Fahrenheit. Several warmup rounds are normally required to ensure proper weapon performance. The rate of fire is necessarily slow until weapons have been warmed; this is especially true for weapons having a hydropneumatic type of recoil.

d. Sights/Optical.--Sights and optical parts present special problems. All sighting equipment is kept at outside temperatures to prevent fogging. The gunner is especially careful not to breathe on the sight lens, as it causes the lens to fog. If it becomes necessary to take optical instruments into a warm shelter, they are wrapped in heavy blankets prior to entering the shelter to provide for gradual warmup. They are kept wrapped in blankets at least 4 hours to prevent moisture damage. Another problem encountered on all weapons is the leveling of bubbles. Bubbles become enlarged and sometimes separate. Vigorous rubbing of the level vial with the fingers usually brings the bubble back together again.

e. Aiming Posts.--The placing of aiming posts varies in complexity with the depth of the snow. In too little snow, posts cannot be placed in the frozen ground and may have to be frozen into #10 cans to obtain a firm base. If snow is deep, and if a hole has to be dug in it to emplace the piece, trenches may have to be dug to see the aiming posts because of the low level of the sight.

f. Aiming Circle.--The use of the aiming circle or compass to lay weapons on the proper azimuth is difficult because of the declination constants encountered.

g. Fire Direction.--Use of the plotting board is recommended over the grid firing chart with the range deflection fan until a sheltered, heated fire direction center can be established. There is less likelihood of losing small pieces of equipment. However, the plastic board tends to become brittle at low temperatures, and care is required to prevent it from shattering.

h. Selection and Preparation of Positions.--Careful selection is necessary in order to obtain positions capable of supporting the plan of operations. Supplemental positions may be necessary in greater numbers in some areas. Defilade positions provide a maximum of counterfire protection, but the high masks will generally interfere with accomplishment of supporting fires. Positions with a minimum mask or with great depth to reduce the mask should be selected when available. Communication equipment should be positioned to provide the greatest range capability without being observed by enemy ground observers. Positions with more than one exit will be difficult to find; however, the unit should be capable of moving into many relatively secure areas nearby if attacked. Artillery pieces are positioned to take the greatest advantage of the terrain. Survey control should be provided on the landing force artillery grid and be accomplished prior to firing. It is generally done by triangulation, resection, and trilateration techniques. Traverse methods are employed in the position area survey. Azimuth-gyro-surveying instruments and tellurometers for survey operations will require augmentation since considerable man-packing of heavy equipment will be necessary.

2315. EMPLOYMENT OF TANKS

The tactical and combat missions assigned to tanks in cold weather operations are the same as those assigned in normal operations. Tactics and techniques employed are compatible with those delineated in FMFM 9-1, Tank Employment/Antimechanized Operations.

a. Effect of Deep Snow and Extreme Cold on Tanks.--Tanks are protected from cold damage by employing special lubricants. Tanks need special grouser tracks for movement over icy areas. Engine warming equipment is required for starting. Wet snow packed in the tracks causes them to be thrown. Frequent halts are required to remove this snow from tracks and other vital parts.

b. Effects of Extreme Cold on Personnel.--Tanks are equipped with heaters; however, in extreme cold, heaters may not always provide sufficient warmth to sustain efficient crew performance. The heat of the engine can be employed as a warming agent for tank crews and accompanying infantry when other means are not available. Care is taken to prevent snow blindness of drivers and crews of the tanks and other vehicles.

c. Movement.--All movement is limited. Deep snow in the winter and the mud in the spring and summer have adverse effects on the mobility of tanks. In wet snow 3 to 5 feet deep, tanks are immobilized. Dry snow and ice cause fewer operating difficulties. Tanks can maintain moderate speeds in fine dry snow not over 3 feet deep. After the snow has been packed down, normal speeds can be maintained. Lakes, streams, rivers, and swampy tundra may become routes for tanks during winter months. Tank units advancing across country avoid heavy woods and deep drifts and take advantage of wind-swept ridges where snow cover is thinnest. Tank movement in unfamiliar terrain is preceded by patrols. Reconnaissance reports include

information on the snow depth and ice thickness. Short-range weather forecasts are also important in planning movements.

d. Observation.--The short periods of daylight in the arctic areas and the difficulty of concealing movement in snow-covered terrain causes an increase in the tank unit's night movements. Night movements are frequently aided by clear atmosphere and bright moonlight. Deep snow provides concealment, but increases the difficulty of orientation on the terrain. Long movements require the use of navigational aids. The vision of crew members may be limited by frost formation on vision blocks or by fog which is frequently found in cold areas. Vision devices can be coated with anti-frost compounds or similar materials.

2316. EMPLOYMENT OF AMPHIBIOUS VEHICLES

Employment of amphibious vehicles in cold weather operations conforms to the general principles delineated in FMFM 9-2, Amphibious Vehicles. Amphibious vehicle units operating under conditions of extreme cold are faced with problems of mobility, added maintenance, and survival of personnel. Maintenance of vehicles is a major problem, based on behavior of the vehicle under conditions of extreme cold as well as difficulty which personnel experience in performing service because of the cold. Service facilities are difficult to establish and maintain. Vehicles are winterized through addition of proper weight oils and lubricants and installation of heaters. Special training of personnel is essential before committing amphibious vehicle units to combat in cold weather regions.

a. Mobility.--Tracked amphibious vehicles may operate in areas of frozen ground or snow, or in areas where frozen ground has melted to some degree during warmer weather, creating streams and areas of mud. In loose snow over 20 inches, LVT operations are severely restricted. When operating over frozen ground, extreme care is taken to avoid broken and uneven areas. During melting periods, the formation of streams and extensive mud areas present formidable obstacles to amphibious vehicle operations.

b. Logistic Considerations.--Weather conditions and terrain in arctic regions restrict the efficiency of resupply and ability of LVT units to maintain vehicles and store supplies. The importance of a flexible, practical logistic support plan cannot be overemphasized. Amphibious vehicle units may provide the principal means of moving supplies both from ship-to-shore and in subsequent operations ashore. Logistic considerations of increased importance while in arctic regions include continued supplies of hot rations, water, clothing, lubricants and oils, and spare parts.

c. Vehicular Considerations.--The problems involved in operating amphibious vehicles over arctic terrain and in very cold temperatures are complex. Detailed prior planning, preparation of vehicles, and training of personnel are required if arctic operations are to achieve success. Principal vehicular considerations include:

(1) Condition of Suspension System.--Wet snow may become packed in the tracks of amphibious vehicles, temporarily restricting or immobilizing them. The same effect may result from ice, which is more difficult to remove. Tracks freeze to the ground in moderately cold weather, occasionally to the degree that tools may be required to extricate the vehicle.

(2) Carbon Monoxide Hazard.--Intense cold, strong winds, and heavy snowfalls all induce personnel to seek whatever shelter is available in arctic regions. The interior of the LVT offers warmth and protection from the elements. Care is exercised to ensure that persons seeking this shelter do not suffer carbon monoxide poisoning.

(3) Main Engine.--The greatest problem inherent in cold weather engine operation is lack of engine lubrication resulting from thickened oil. Cold-weather starting procedures for LVT main engines delineated in FMFM 9-2, Amphibious Vehicles, and appropriate technical publications, are followed to the letter.

(4) Batteries.--Battery power decreases rapidly during cold weather and batteries cannot be satisfactorily charged once the electrolite temperature is less than 0 degrees. Extended hours of darkness and low temperatures create increased demands on electrical systems, and batteries in particular. Protection is afforded batteries by servicing and cleaning them frequently. Batteries often must be heated before recharge and use during cold weather.

(5) Winterization Kit.--The LVT winterization kit is designed to supply large quantities of fresh heated air to preheat and maintain warmth in the personnel and cargo and engine compartments. The kit may be used to heat a vehicle which has been idle for a long period of time, or as a standby heater to maintain satisfactory compartment temperatures during periods when engines are not operating.

2317. EMPLOYMENT OF ENGINEERS

Engineers in cold weather operations carry out their normal combat, combat support, and technical support missions, in accordance with the general procedures delineated in FMFM 4-4, Engineer Operations. Existing engineer organizations can be adapted without difficulty to northern conditions. Modifications are usually required in the type and nature of their equipment. This, in turn, necessitates some revision of specialist requirements. Such modifications and the overall requirement for engineer units vary with the season, the area of operations, and the mission of the landing force. During the planning stages, these factors receive detailed study to determine the proportion of engineers in the task force and the types of equipment and organization they require. Environmental factors increase the volume and scope of engineer operations and the difficulties attendant to execution of these operations. The scarcity of roads increases the need for road construction. At the same time, the effect of the extremes of climate increases the manpower and equipment effort required for both road construction and maintenance. The numerous streams, swamps, and lakes necessitate increased quantities of stream-crossing equipment and correspondingly increased effort for its installation and maintenance. Cross-country movement of large forces without augmented engineer effort is difficult. The problems confronted in construction are magnified, as are the problems of installation of field fortifications. While water potential is normally adequate, the difficulties of supplying potable water by conventional methods are increased.

Section IV. LOGISTICS AND COMMUNICATIONS

2401. GENERAL

Logistic planning and operations are conducted in accordance with the procedures delineated in FMFM 3-1, Command and Staff Action; FMFM 4-1, Logistics and Personnel Support; and LFM 02, Doctrine for Landing Forces. An early determination of logistic requirements for cold weather operations is imperative. Because of the unusual weather and terrain conditions and the length of supply lines, the lack of some special items of supply or equipment may seriously jeopardize the success of the amphibious operation. In addition, all of the many types of special equipment required may not be readily available from normal supply sources. Where routes of communication to the projected area of operations are affected by the seasons, it may be necessary to move the bulk of the supplies and equipment by water during the summer. When long overland hauls are involved, winter may be the only practical period of the year to bring in heavy equipment. Unless the area contains a good airfield or is served by an all-weather road or a railroad, supplies sufficient to last through the full freezeup and the spring breakup may have to be accumulated and distributed before the advent of these seasons. Special equipment requirements are determined in detail as early as possible in the planning phase because of the difficulty of special procurement and resupply. After action has been initiated to ensure the availability of special equipment, all other supplies and equipment are considered, item by item. A decision is then made as to what modifications, if any, are required, and what items will be needed in special quantities.

a. Logistic Support Elements.--The ratio of combat service support elements to combat troops increases in cold weather operations. This is a result of increased requirements for equipment maintenance, and a corresponding decrease in individual efficiency because of the weather and operating conditions. The disproportionate ratio of logistic to combat effort causes commanders to scale their supply and equipment level close to minimum requirements. This is necessary even though the severity of environmental conditions, lack of local resources, and difficulties of resupply may tempt them to oversupply and overequip in the interest of safety.

b. Logistic Phasing.--The type of equipment used varies with the seasons. When the mission calls for any protracted stay in the area, transportation, storage, and labor requirements can be reduced by phasing the seasonal clothing and equipment to arrive only as needed. A reasonable margin of safety is allowed at all times. Any man-hours diverted from transporting or maintaining nonessential items of equipment is applied to increase combat effectiveness of the landing force.

c. Centralized Service.--Special consideration is given to furnishing as much support as possible from established bases, where existing facilities result in more efficient operations. Every logistic task that can be performed outside the area of operations decreases the ratio of support troops to combat troops, reduces the amount of heated shelter required in the area of operations for the conduct of logistic tasks, and reduces the quantity of supplies necessary to support such elements. The need for supply personnel with the force can be reduced by segregating and packaging supplies at the supporting echelon in order to eliminate or reduce such supply activities by combat units. Provision of simple,

prefabricated, portable shelters capable of erection, dismantling, and movement by using units reduces the number of construction engineers needed.

d. Changes During Various Seasons.--The extremes and wide ranges of temperature and differences in cross-country mobility experienced from one season to another requires support units of types and numbers that change from summer to winter. To relieve supply and transportation requirements and to retain the mobility of the force, the basis for determining combat service support requirements is constantly reviewed and adjusted as necessary.

e. Preparation of Equipment and Supplies

(1) Equipment.--Advance preparation of equipment before movement to cold weather areas is essential. Installation of winterization kits on vehicles, for example, requires considerable use of power tools. This can best be accomplished in shops. Close tolerance of adjacent moving parts may result in subsequent binding of the movement when subjected to the contraction of metal occasioned by extreme low temperatures. To correct this condition, tolerances have to be changed in some cases by an extremely minute amount. Such modifications may have to be accomplished by the manufacturers of the equipment. Technical instructions insofar as they pertain to the winterization of each type are examined in advance. Necessary modifications are made before equipment is moved to the area of operations.

(2) Supplies.--Those items susceptible to damage by freezing are segregated to permit special transportation, handling, and storage. Fluids normally packaged in glass containers are packaged in metal or plastic containers, when contents permit. Because of the likelihood that protected storage will not be available, waterproof packaging is necessary for many items. The prevalence of wet ground in the summer (marshes and muskeg) and the great number of streams and lakes, restrict communications so that airdrop of all types of supplies will frequently be used.

2402. SUPPLY

Local resources in cold weather regions are limited. It is, therefore, imperative that complete supply requirements for the assigned mission be analyzed in detail. Special cold weather equipment is procured early in the planning phase. Detailed supply plans are prepared to include provision for both emergency and routine resupply by air. Minimum supply levels are higher than for normal operations because of the difficulty of resupply during periods of adverse weather. The supply problem in the arctic and subarctic is complicated by the fact that advance bases may become inaccessible by sea at certain periods of the year. Resupply by air may be the only means of providing requirements at such a time. However, resupply by air is satisfactory only for a brief period. The only dependable means for the movement of bulk cargo is by ship.

a. Individual Equipment.--Special items of supply and personal equipment are limited to those required by the terrain and environmental conditions. Articles to be considered include insect repellent, mosquito head nets, snow goggles, lip salve, sunburn preventive cream, candles, pocket knives, and waterproof matchboxes. The extra equipment required for heat and shelter, including the clothing each man wears, is kept within limits which permit transport by manpower alone, while still not reducing

the operational capabilities too drastically. Special means are provided for transporting the bulk of equipment, whenever possible, to allow each man maximum freedom of action during combat and on the march.

b. Rations.--In cold weather, it may be necessary to augment the normal ration by additional servings of hot soups and hot beverages.

c. Repair Parts.--In general, increased stocks of repair parts are needed for all equipment with the greatest increase occurring with those parts dependent on lubrication for long life.

d. POL.--The increased ratio of cross-country movement and the extensive use of tracked vehicles with high fuel consumption characteristics are considered when planning POL requirements for cold weather operations. The normal type of military issue gasoline used in the temperate zones is satisfactory for use in extreme cold, although quick starting of cold engines is aided somewhat by using gasoline which has a higher than normal vapor pressure rating. Provision of alcohol for addition to gasoline used in engines is a must and assists in reducing troubles caused by water which otherwise would freeze in the lines. Whenever possible, vehicle fuel tanks are kept filled to decrease condensation. When gasoline is used for space heating, requirements increase accordingly.

(1) Special cold weather type oils and greases which remain fluid in extreme cold are required for northern winter operations. The special oils and greases needed range all the way from extremely light oils used for lubrication of instruments to wheel bearing grease.

(2) The change from summer to winter operations, or vice versa, requires a complete change of lubricants and hydraulic fluids. The necessity for a complete change of all lubricants in vehicles and the changing of lubricants, hydraulic, and recoil fluids in artillery and other equipment at the approach of cold weather requires unusual amounts of this type of supply. The low viscosity of motor oils used during cold weather results in higher consumption rates because of oil escaping past piston rings and oil seals. Lubricating and oil change intervals must be reduced (changes made more frequently) when these low viscosity lubricants are used.

e. Storage.--The extreme low temperature of northern regions necessitates temporary shelter or group-type tentage for the storage of some classes of supplies. A particular problem arises in connection with the handling of subsistence. Perishable items of food procured in a fresh and unfrozen state and liquid items in glass containers must be protected against freezing. One-time freezing and thawing normally causes no noticeable change in the character or quality of nonperishable rations, but alternate freezing and thawing may cause considerable loss. The sectional, portable tent-type shelter may be used for the storage of supplies which must be protected from low temperatures. Stacks of supplies are sited to minimize the effects of drifting snow, and are placed far enough apart to prevent the snowdrift from one stack from burying another and to facilitate keeping traffic lanes open between supply areas. Supplies, particularly those in sacks, are never stacked on bare ground or ice in winter. They freeze to such surfaces and are difficult to remove without damage to the container and its contents.

f. Establishment of Dumps.--Forward dumps of vital supplies are established as landing force elements advance in order to shorten routes

of supply. The initial minimum dump of classes I, III, and V supplies is established as soon as feasible after H-hour.

(1) Requirements for Dump Sites.--Initial dumps are located near an adequate water supply. During thaw periods, they are not placed on flat ground in the vicinity of streams or rivers because of the danger of flood. If wooded areas are available, they provide cover and concealment, and may be used as a source of fuel, construction material, and shelter. In the absence of trees, other protection is needed to serve as a windbreak and thus reduce windchill to personnel. When heavily wooded areas are used as dumps, dispersion or some other protection from fire is effected. Low areas of swamp or muskeg are avoided. Preferable areas are those which can be reached by LVT's from the seaward side and which are along the sites of actual or planned roads.

(2) Preparation of Dumps.--Preparation of dumps is accomplished concurrently with the actual unloading of supplies at the site. If the soil will support excavation, supplies are dug in to afford greater protection. Whatever the method of protection, heavy equipment and adequate demolition material are required. In preparing beach dumps and roadways, lightweight matting may be used. Unit distribution of supplies is provided. It is desirable to establish central maintenance facilities near the dump site for the care of the vehicles used for distribution. When timber is available, it aids in dump site preparation. Logs of 10-inch or 12-inch diameter may be cut, skinned, and laid as a base for each cache of supplies. Such a base provides a support and reduces loss caused by moisture. Additional tarpaulins and dunnage are required for storage.

(3) Lighting and Marking.--When the tactical situation permits, adequate lighting within the dump area is provided during the initial phases of the landing and during the winter months. Each dump is well marked with flags or other devices for ease in location and identification after a snowfall.

g. Exchange of Equipment.--A major supply problem in extreme cold weather operations is the exchange of equipment necessitated by seasonal transitions. The quantity of equipment to be exchanged is extensive. The individual Marine's full arctic field load weighs approximately 118 pounds. Subtracting the battle load (individual weapon, ammunition, entrenching tool, and protective mask) of 26 pounds, the total weight of the individual equipment to be exchanged is still 92 pounds per man or approximately 830 short tons per division. As a result, the turn-in of individual cold weather clothing and issue of the summer clothing requires considerable effort by support units. The tonnage itself can be handled, but part of the equipment such as skis and snowshoes are bulky and require additional transportation and/or storage space. Moreover, skis and snowshoes must be blocked and bundled for shipment or storage. No exchange is required for tentage or tracked vehicles since both are used for summer operations. However, all sled equipment becomes useless in summer operations and is removed from combat and combat support elements.

2403. MAINTENANCE

The importance of maintenance in cold weather operations is impressed on all personnel. Special emphasis is placed on organizational maintenance. Maintenance of mechanical equipment in extreme cold is exceptionally difficult in the field. Even shop maintenance cannot be

completed with normal speed because the equipment must be allowed to thaw out and warm up before satisfactory repairs can be accomplished. In the field, maintenance is undertaken under the most difficult conditions. Bare hands stick to cold metal. Fuel in contact with the hand causes freezing in a matter of minutes. Engine oils, except subzero grade, are unpourable at temperatures below minus 40 degrees Fahrenheit. Ordinary greases solidify and lose their lubricating qualities. These difficulties increase the time required to perform maintenance. At temperatures below minus 40 degrees Fahrenheit, maintenance requires up to five times the normal amount of time. For example, the time required to warm up a vehicle so that it is operable at temperatures as low as minus 50 degrees Fahrenheit may be 2 hours. Vehicles in poor mechanical condition probably will not start at all, or only after many hours of laborious work. (See TM 9-207.)

a. Functional Problems.--Conditions of a general nature that affect the operation of equipment and influence winterization procedures include:

(1) Bearing lubricant congeals.

(2) Oil congeals in gear cases (transmission, transfer, differential, steering, right-angle drives, and final drives).

(3) Rubber becomes rigid.

(4) Brake shoes may freeze fast to brake drums.

(5) Metal, plastic, and rubber parts break more rapidly.

(6) Paint on material cracks more easily when exposed to extreme cold.

(7) Condensation on machined surfaces requires more care to guard against corrosion and icing.

(8) Overlubrication causes parts to bind and lock.

(9) Springs fail and break.

(10) Bearings bind and lock unless properly cleaned and replaced with arctic lubricant.

(11) Leather items crack unless properly lubricated.

(12) Insulation on wire cables becomes brittle and cracks unless arctic cables are used.

(13) Air hoses fail when doubled or straightened unless arctic type hoses are installed.

(14) Dry cell batteries fail to function after a few hours exposure to subzero weather.

(15) Cold weather clothing for personnel hampers operation of some controls; e.g., choke and throttle controls, switches, triggers, and small latches.

(16) Storage batteries will not accept a charge or furnish sufficient current to operate electrical components.

(17) Ice crystals form in fuel tanks from condensation of water vapor and clog fuel systems.

(18) Ice forms on windshields and impairs visibility.

(19) Operations in loose or deep snow or icy roads or bodies of ice and partially frozen swamps and tundra result in difficulties in firing and traveling.

(20) Ice crystals form in airbrake tanks from condensation of water vapor and clog the air system.

(21) Master and wheel brake cylinders become inoperative due to use of insensitive types of hydraulic brake fluid.

(22) Hydraulic brake lines become brittle in extreme cold and are easily broken by shock loads or bending.

(23) Components of hydraulic units become inoperative in extreme cold due to use of insensitive types of hydraulic fluid.

(24) Engine oil congeals.

b. Requirements.--Requirements of a general nature that affect maintenance directly and require planning, coordination, and advance preparations before a cold weather operation include:

(1) Shelter for materiel requiring maintenance.

(2) Proper clothing and tools for maintenance personnel.

(3) Adequate portable heaters.

(4) Suitable methods to store and issue antifreeze materials.

(5) Sufficient lighting equipment.

(6) Supply of repair parts for equipment.

(7) Sufficient equipment for removal of snow and ice.

c. Preventive Maintenance.--Preventive maintenance consists largely of the application of a few general rules to all types of materiels:

(1) Materiel is used only for the purpose for which it was originally intended.

(2) Materiel is inspected and examined daily to discover any unusual conditions or missing parts.

(3) All applicable technical maintenance instructions are observed.

(4) Unusual conditions are brought to the immediate attention of higher authorities.

(5) Alterations or repairs that are not authorized are not attempted unless urgent conditions exist that require every effort to keep equipment operating.

2404. TRANSPORTATION

Extreme cold weather operations cause the commander landing force to use a correspondingly larger number of different means of transportation. Wheeled vehicles are roadbound to an unusual extent. Low ground pressure track vehicles are extremely useful for cross-country transportation during all seasons.

a. During the summer, water courses may furnish valuable transportation routes. Boats and amphibious vehicles can be used, but in many cases, native craft are more suitable for transport purposes. Since boats may have to be carried over portages by the crew, light craft are preferred to heavier boats. Rivers are generally fast-flowing, usually shallow, and contain rapids. Accordingly, boats with a draft in excess of 30 inches are seldom suitable.

b. Aircraft serve as the only means of transportation that can be depended on to operate in all areas of the north in all seasons. When ice is present on rivers and lakes, but not of sufficient strength to support loads, helicopters and airdrop from fixed-wing aircraft may be the only possible method of transporting personnel, supplies, and equipment within the area. (See figure 19.)

c. There is no essential difference in the operation of wheeled vehicles in the north during the summer as compared to their operation anywhere over rough, undeveloped roads. The extreme cold, ice, and snow

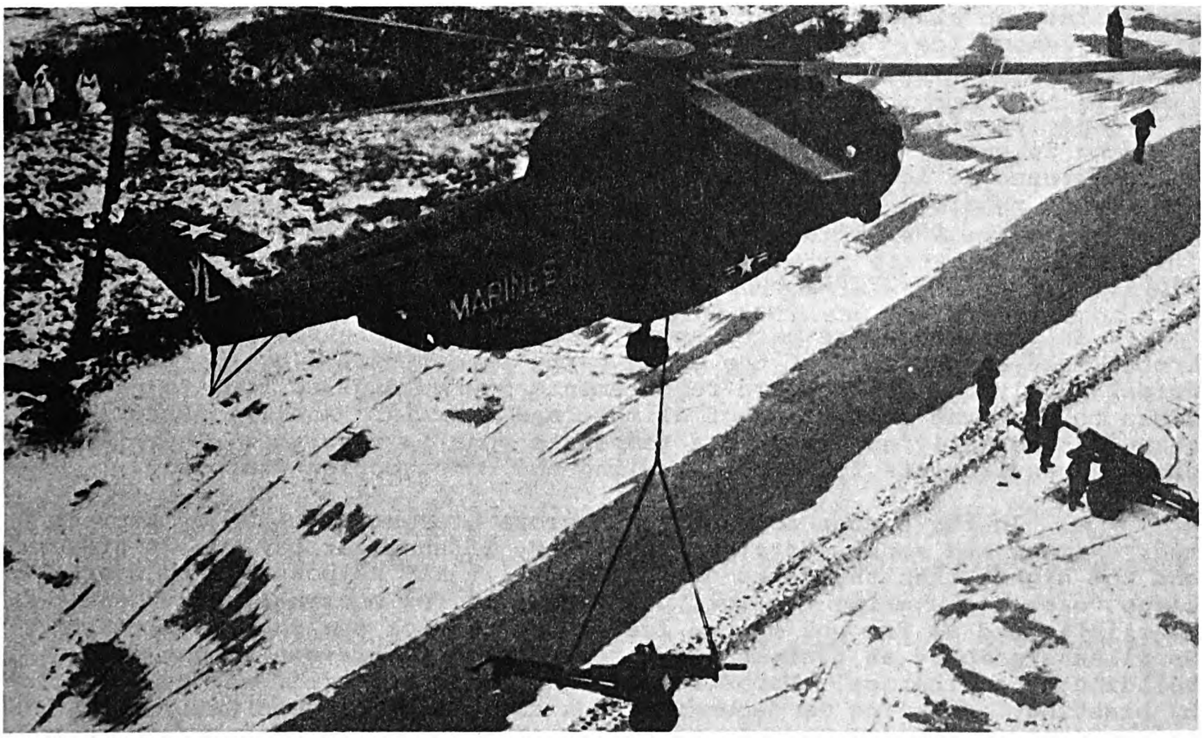


Figure 19.--Helicopter as a Means of Transporting Equipment.

encountered in the northern winter entail special driving and maintenance techniques. (See apps. C and D.) Trucks operated over winter roads are equipped with winches. Training of drivers and mechanics includes:

(1) Driving techniques on slippery roads and in deep snow.

(2) Proper operation of engine preheaters.

(3) Special indoctrination as to the necessity of relying on the standby engine heater rather than the idling of motors to keep them warm.

(4) Special maintenance procedures.

(5) Observing load limitations as set forth in pertinent technical manuals.

(6) Dangers of carbon monoxide poisoning.

d. Even though the most careful training has been given to drivers and mechanics, leaders at all echelons exercise constant supervision to ensure that safe driving speeds are observed, and that necessary maintenance is performed regardless of the difficulties imposed by the cold.

e. To enable them to operate efficiently, drivers of oversnow type vehicles and equipment require considerable training, including the use of compasses and electronic aids to navigation.

f. Aircraft used in the extreme cold require winterization. They may operate on either skis or floats. Extra maintenance is usually necessary to remove ice. Auxiliary power sources and portable heaters are needed to assist engine starting.

g. In effecting resupply by airdrop, breakage can be reduced by dropping in snow. When necessary to freedrop on hard surfaces such as frozen ground or ice, less breakage occurs if supplies are dropped from the lowest possible altitude, so that the packages strike the surface at an acute angle, thereby glancing after the initial impact.

2405. SHORE PARTY OPERATIONS

In planning shore party support for an amphibious operation in the arctic, the composition of the shore party is controlled by the fact that normal supply and maintenance requirements are multiplied four to nine times to meet the conditions of climate and terrain. A shore party larger than that normally employed in a temperate zone is required. There are increased requirements for cargo handling and construction equipment.

a. In the summer months, beach areas present problems of extreme mud, swamps, and rocky terrain. In winter, if shelf or bay ice is present and not higher than the decks of the ships, it may be possible to moor cargo vessels alongside the ice, using deadmen for mooring. Heavy equipment is landed as far out on the ice as the boom of the ship will reach. Supplies are moved as fast as they are unloaded to prevent weight from building up on the ice. Ramps for landing ships and craft may be prepared by blasting. Shipping is dependent upon the season of open water which varies from 3 weeks to 4 or 5 months, depending upon the area. Accordingly, it is difficult to schedule resupply shipping. During ice free periods, unloading operations are conducted at maximum speed.

b. Shore party operations are restricted by the temperature of the water. Drying stations are established where wet clothing can be exchanged for dry, and personnel may be warmed. The efficiency of the shore party is reduced sharply during severe weather since personnel must take frequent breaks for warmup purposes. Warm stimulants and food are provided early in the operation and consumption rates are high. Consideration is given to beaching an LST or similar vessel for the use of the shore party as protection from the weather.

2406. MEDICAL

Personnel engaged in amphibious operations in cold weather should be in excellent health. From a medical standpoint, all medical and dental operations which can be anticipated are performed prior to departing for cold weather areas. The isolated duty precludes any outside aid and the task force is prepared to cope with potential diseases and injuries. An adequate amount of such medical supplies as camphorated chapsticks, sunburn ointment, talcum powder, and vitamins are carried. Since some type of eye protection is required under conditions of ice and snow, an adequate number of dark goggles or sunglasses are necessary. Special medical techniques and sanitary procedures necessary to protect the health of personnel engaged in amphibious operations include:

a. <u>Prevention and Treatment of Immersion</u>.--The danger of immersion is great in amphibious operations. Prior to the actual landing, every effort is made to prevent immersion or to rescue immersed personnel immediately. During the landing, small boats are assigned the duty of picking up any persons who have fallen into the water and treating them for hypothermic immersion.

b. <u>Evacuation of Casualties</u>.--Rapid evacuation of sick and wounded personnel to heated aid stations takes precedence over all treatment except for the control of hemorrhage and minimal splinting of fractures. Evacuation is effected by the fastest possible means.

c. <u>Treatment of Casualties</u>.--Subarctic warfare complicates the routine treatment of casualties. Casualties arrive in poor condition as a result of the slower means of evacuation, the greater distance to the aid station, the traumatic effect of cold, and the difficulty of administering to the wounded. The greater amount of clothing worn and the freezing of blood soaked bandages is a further complication. At the battalion aid station, the following procedures are recommended in order of priority:

(1) Control of hemorrhage.

(2) Treatment of shock (warming).

(3) Receiving and recording casualties.

(4) Examining and sorting casualties and returning fit personnel to duty.

(5) Treatment such as administration of narcotics, dressing and redressing wounds, and splinting fractures.

2407. COMMUNICATIONS

Communication personnel carry out their normal combat support missions in cold weather operations in basically the same manner as in most temperate

weather conditions; however, installation time is greater for establishment of any type of communication. Special equipment features such as arctic type batteries (see 2000 series technical manuals) and equipment covers must be used. Personnel must receive special training in the operation and maintenance of communication equipment. More frequent breakdown and longer time for repairs create the necessity for larger pools of reserve spares. The full efforts of well trained operators and repair personnel, therefore, are required for satisfactory communications. Reliance on one means of communication during cold weather operations is inadvisable. Alternate means and routes should be employed whenever possible.

a. <u>Messengers</u>.--Messengers lack speed on the ground although they are reliable and secure. In making long runs, they should always be dispatched in pairs, particularly during periods of extreme cold. Aerial messengers are more rapid and are also capable of airdrop and pickup of messages.

b. <u>Radio</u>.--Radio and other electrical transmission means take on increased importance as means of communiction, but they are not without problems. Radios must be turned on and warmed up every few hours. Moisture from the breath freezes on the cover plates of microphones causing the equipment to become inoperative; thus, microphone covers are a must. Power supply efficiency is decreased which necessitates keeping dry batteries warm and wet cell batteries in a high state of charge. High frequency radio transmission and reception is impaired by magnetic storms, or aurora borealis and ionospheric disturbances, which may completely black out reception for hours or even days. Use of very high frequency (VHF) or ultra high frequency (UHF), including FM voice and multichannel radio, is often preferable to high frequency (HF), as these are less affected by ionospheric disturbance. Radio equipment operating in the low and very low ranges also experience fewer interruptions from aurora disturbances. Radio communications should offer no exceptional difficulties when emphasis is placed on care and maintenance of equipment, and proper frequencies as well as proper antenna systems are employed. Since suitable grounds are difficult to obtain due to the frozen turf, installation of a counterpoise will usually be necessary. For detailed information on counterpoise, see TM 11-666, <u>Antennas and Radio Propagation</u>.

c. <u>Wire</u>.--Wire communications of any magnitude are difficult to install and maintain unless integrated into wire-multichannel radio systems. Although not necessarily limited to local use, consideration must be given to the longer time required to install and maintain long lines during periods of extreme cold and poor trafficability. Utilization of aircraft for wire laying is effective; however, in most cases, troubleshooting these lines becomes impracticable. Wire also is vulnerable to damage from brittleness during extreme cold.

d. <u>Visual and Sound</u>.--Visual means of communication are particularly effective in air-ground operations or when atmospheric conditions or security requirements preclude the use of radio. Arm-and-hand signals, panel sets, and pyrotechnics are among the types used. However, blowing snow, haze, ice fog, and other conditions often reduce the range and reliability of visual signaling during cold weather operations. Sound in still cold air carries for greater distances, which can impose problems of security since the enemy can intercept at greater distances. Sound is effective primarily for alerting and warning use.

CHAPTER 3

MOUNTAIN OPERATIONS

Section I. INTRODUCTION

3101. GENERAL

Mountain warfare encompasses operations in mountainous or hilly country where conditions of ground and climate require modification in landing force organization, training, equipment, and tactics. Mountain warfare is categorized in terms of mountain operations and/or alpine operations.

a. Mountain Operations.--Mountain operations are those which can be conducted by normal elements of a landing force operating on or near an axis of communication in mountainous country. Such operations require some special training to adapt troops to mountains and some substitution and/or addition of equipment. Normally, they do not involve movement by ski or snowshoe, nor advanced rock and cliff climbing.

b. Alpine Operations.--Alpine operations are those conducted by troops especially organized and equipped for combat at high altitudes over snow-covered and/or precipitous mountain terrain and rock masses which could prove inaccessible to other troops. Operations in an alpine environment require the highest standard of specialized training in military rock climbing and ski mountaineering. Movement over such terrain could not be accomplished without the aid of special equipment. Alpine operations are beyond the scope of this manual. For details of such operations, see FM 31-72, Mountain Operations.

3102. MOUNTAIN TERRAIN

The mountain areas of the world are depicted in figure 20. Mountains are land masses higher than 500 meters with steep slopes. Mountains may be

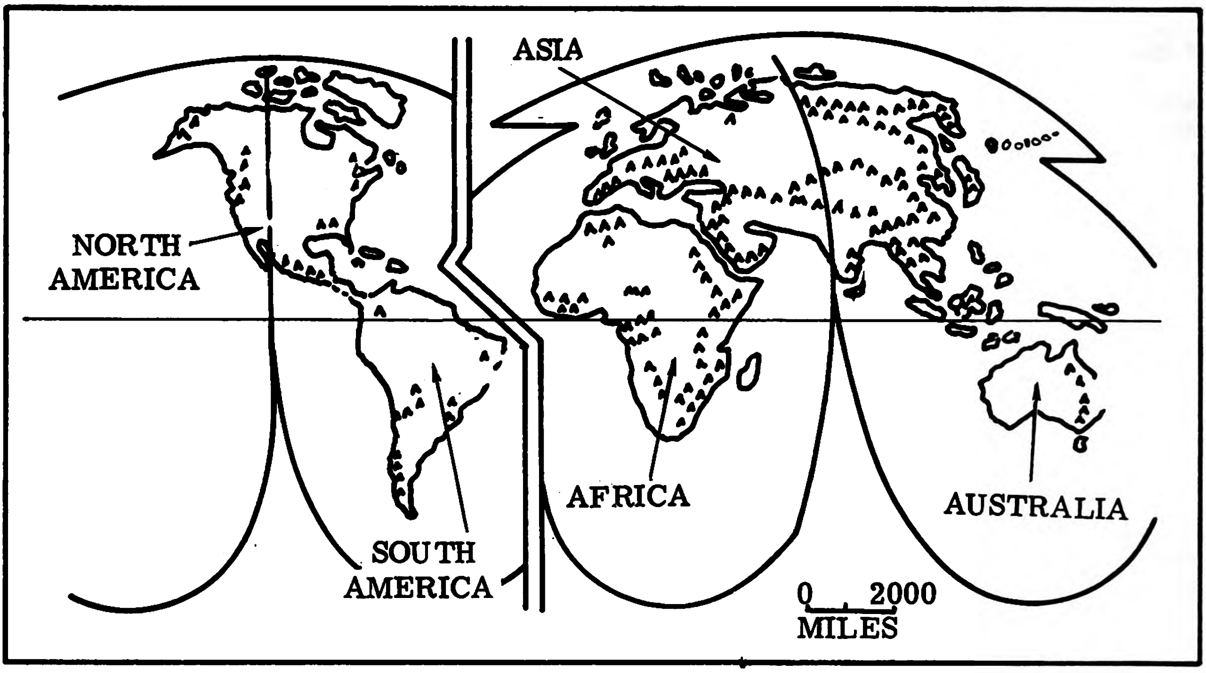


Figure 20.--Mountain Areas of the World.

composed of exaggerated terrain features and compartmentation. Frequently, they possess heavy woods or underbrush, rocky or glaciated peaks, glaciers, and snowfields. They are characterized by erratic weather. Slopes in the mountains generally vary from 4 to 30 degrees. Cliffs and/or precipices may be vertical or even overhanging. Mountains may consist of an isolated peak, single ridges, or complex ridges extending for many miles.

a. Terrain.--Mountain terrain displays the resistant qualities of the rocks from which the mountains were formed. The ridges, canyons, cliffs, and valleys are evidence of the process of erosion. Rugged relief, with steep slopes, results in swift streams. The slopes themselves often limit or prevent the movement of mechanized-motorized means of transportation. The inaccessibility of mountain areas is reflected in the lack of roads and railroads. Those roads and railroads which do exist are found where passes or gaps cross the ranges. Canalization of traffic with the attendant danger of ambush is a prime consideration in planning and conducting mountain operations. The heights must be controlled or neutralized to permit use of the corridors.

b. Climate.--In those areas where the mountain heights reach into regions of year-round snow, climatic conditions approach those found in the boreal forests of polar regions. In low latitudes (0 degrees to 15 degrees), the zone of permanent snow appears above 3,600 meters. Snowlines and timberlines occur at high elevations near the equator and occur at progressively lower elevations as they approach the poles. Operations in these areas are planned specifically to cope with conditions of snow and extreme cold. For a detailed discussion of cold weather conditions attendant to mountain operations, see FM 31-70, Basic Cold Weather Manual. Altitude limits of the various types of mountain vegetation correspond with the pattern of vertical temperature distribution. The same succession of

vegetation types is encountered when ascending mountains near the equator as when proceeding northward from the equator. Tropical forests occupy the lower slopes, higher up are mixed forests of broad-leafed types and conifers, and still higher, conifers are alone. Beyond the upper limit of trees, but below the snowline, is a zone of alpine meadow not unlike the tundra of the polar regions.

3103. MOUNTAIN WEATHER

Normally, the weather produced by mountain terrain is extremely severe and subject to erratic patterns.

a. Pressure.--Pressure is lower in mountainous areas because of the altitude. The barometer drops 1 inch for every 1,000 feet of elevation. Decreased pressure causes the air to expand, decreasing the amount of oxygen and moisture content in a given volume.

b. Temperature.--Normally, a temperature fall of from 3 degrees Fahrenheit to 5 degrees Fahrenheit per 300-meter gain in altitude will be encountered. At high altitudes, solar heating is responsible for the greatest temperature contrasts. Less atmospheric interference may create differences of 40 degrees Fahrenheit between the temperature in the sun and that in the shade. The clear air also favors rapid cooling at night. Consequently, the temperature rises fast after sunrise and drops quickly after sunset.

c. Winds.--Winds are stronger and more variable at mountain altitudes. Prevailing winds are channelized and funneled by mountain terrain. Each time the wind velocity doubles, its force against an object quadruples. The passage of the sun across a mountain range generally causes a valley breeze in the morning and a mountain breeze in the afternoon and night. Local winds assume a highly erratic pattern because the sun shines with varying intensities on the uneven terrain.

d. Precipitation.--Precipitation occurs more often on the windward side than on the leeward side of a range. This produces frequent fogs and denser vegetation on the windward side of a range. Erratic variations in solar heating create and dissipate clouds suddenly, causing violent thunderstorms of short duration. Pressure fronts may be trapped by the terrain and cause snow or rainfalls of long duration. Heavy rain or snow is channelized by the terrain creating dangerous water races and avalanche paths.

e. Lightning.--Lightning is frequent in the mountains. It is attracted to the high points, metal structures, and dominant objects such as lone trees, buildings, antennas, and ridges.

3104. PRINCIPAL EFFECTS OF MOUNTAINS ON LANDING FORCE OPERATIONS

The planning and execution of mountain operations attendant to an amphibious landing require a thorough knowledge of the area of operations and the ability to cope with the special conditions of the environment. Elevation is not the sole indication of the degree of difficulty encountered in such operations. The general configuration of the mountains themselves and the relationship between their elevation and that of the base from which they rise are equally indicative of the problems to be encountered. Decreased oxygen in the air as the elevation increases requires considerable acclimatization of men and animals. It frequently dictates

major adjustments of landing force vehicles, weapons, and equipment. Principal effects of the mountain environment on landing force operations include:

a. Movement and Mobility.--Mountain terrain presents great difficulties to the movement and maneuver of the landing force. The restrictive nature of steep valleys and defiles limits the size of landing force elements which can operate efficiently. The lack of adequate road nets also restricts movement and tactical maneuver and complicates the provision of adequate logistic support. The construction of new roads and trails is difficult and time-consuming. Even when a satisfactory road net is available, the enemy may block advancing landing force units by blowing up bridges; blasting out sections of road along steep slopes; or blocking defiles with slides of snow, rocks, or timber. In such cases, vehicle traffic comes to a halt and assault elements of the landing force continue the advance on foot or by means of helicopters.

b. Observation.--Extreme heights in mountains generally increase the range of ground observation. This gives the force holding the highest ground a distinct advantage. While heights increase the range of observation, compartmentation and erratic weather increase the number of required OP's echeloned in altitude as well as in width and depth. Constantly shifting currents of warm and cold air produce sudden atmospheric changes so that little reliance can be placed on visibility at any one given observation post.

c. Cover and Concealment.--Cover is usually readily available in deep defiladed areas and broken terrain. This may permit assault elements of the landing force to advance along a covered approach to within a few yards of a defended position. Digging foxholes and temporary fortifications is generally difficult because of strong soil and hard bedrock. Concealment in the mountain environment is variable. Increased ground observation from heights and narrow fronts may make concealment difficult to achieve. Accordingly, during offensive operations, the landing force must be ready to take full advantage of darkness, traveling storms, fog, and other conditions of reduced visibility.

d. Reorganization.--The degree of reorganization required to equip elements of the landing force for mountain operations depends on the lines of communication and their general accessibility in the projected area of operations. Seasonal and weather conditions exercise a marked influence on the performance of troops and equipment. Mud, high water, humidity, continuous rain, fog, cold, snowstorms, snow conditions, and numerous obstacles to fire and maneuver may dictate some reorganization of landing force elements and the substitution or addition of major items of landing force equipment to cope with such conditions. Effects of these conditions are anticipated and considered in detail and the resulting problems are resolved during the formulation of landing force plans.

e. Personnel Replacements.--When practicable, all replacements for landing force units engaged in mountain operations are given mountain training prior to assignment to a unit.

f. Intelligence.--Accurate information concerning weather and terrain and proper evaluation of the significance of this information are important in mountain operations. Information is secured by ground and aerial reconnaissance. Reconnaissance of terrain and roads is particularly

important in mountainous areas. Information gained from local mountain inhabitants regarding terrain, climate, and weather conditions can verify or substantially increase knowledge previously acquired by the landing force.

(1) Maps.--Maps of mountain regions vary in accuracy and completeness of coverage according to the accessibility of the area. The more populated areas are generally well covered and accurately mapped. Remote areas often are uncharted. In general, maps are of small scale with large contour intervals. They usually do not supply the minute detail required for the conduct of operations by Marine units. Data obtained from existing maps are supplemented by detailed data derived from aerial photographs of the area.

(2) Weather.--Short-range weather forecasts normally cover a 1- to 8-day period and provide information as to the probable temperature, precipitation, humidity, visibility, cloud conditions, and the direction and velocity of the wind. Mountain weather is highly changeable. In exposed places, the weather contrasts sharply with the weather found in the sheltered areas. Weather and terrain are considered as separate elements, but are studied together.

g. Operations.--Changes in equipment and organization are often necessary in preparing a landing force for mountain operations. Conditions vary widely in mountain areas, and each operation requires specific decisions regarding special clothing and equipment. In each case, a careful estimate is used to determine if the standard equipment can function satisfactorily or if special equipment is needed. Standard equipment is used if possible. Special equipment often presents many logistic problems. Within elements of the landing force, there is frequently a requirement for some temporary readjustment of personnel. Engineer and service troops organic to the division are often reinforced because of the increased obstacles encountered. When pack animals are used by the landing force, veterinary and handler personnel are also required.

h. Communications.--Mountainous terrain increases the difficulties of laying wire, creates dead spaces in radio reception, and imposes terrain barriers between adjacent compartments in which the landing force is operating. Use of aircraft reduces the time required to lay wire. Retransmission assists in overcoming terrain obstacles to radio transmission. Additional radios and phones are desirable. Visual signaling and messengers are also used to overcome operational difficulties.

i. Fire Support.--The great differences in elevation and the excellent observation normally encountered in mountain areas provide long-range fields of fire and opportunities to deliver overhead fire. However, the broken ground may cause a net reduction in fire effect. Flat trajectory fires are usually plunging instead of grazing, resulting in small beaten zones and excessive deadspace. Other fire support considerations include:

(1) Reduced Mobility.--Fire support is restricted by the difficulty of moving weapons and ammunition into effective firing positions. Artillery units are normally emplaced near roads. The maneuver of tracked vehicles is generally restricted to the vicinity of roads. Difficulties of ammunition supply for fire support means ashore make it necessary for commanders to enforce a strict economy of ammunition. During the early

stages of the landing, naval gunfire provides an excellent fire support means to overcome the obstacles presented by mountain terrain. Its effectiveness diminishes as the landing force moves inland.

(2) High Angle Fire.--High angle fire weapons such as howitzers and mortars take on increased importance in mountain areas. Because they are well adapted to mountain warfare, they may be provided in greater numbers than in normal operations.

(3) Air Support.--Tactical air operations provide the most mobile and is often the most economical means of fire support available to the landing force. The hazards to flying place some limitations on the use of low-flying, close support aircraft. However, the restrictive nature of the terrain and the limited road nets resulting therefrom present many opportunities for aircraft to render critical support particularly against hostile positions on reverse slopes. Principal handicaps in the employment of aircraft in mountainous regions stem from weather and terrain. Constantly changing weather conditions may make it necessary to cancel air support missions on very short notice. Terrain may also limit the number of airfields from which aircraft can operate.

j. Logistics.--Mountainous terrain complicates all aspects of logistic support. Underestimation of the logistic situation can lead to serious problems. When snow and cold are encountered, logistic problems are increased. Helicopters are the best means of logistic support in mountainous terrain.

(1) Supply.--Local resources are normally available in such meager quantities and variety as to be negligible. Elements of the landing force are completely dependent on normal supply channels. Supply facilities are located as far forward as possible. Unit distribution is the rule, and it may be necessary to establish small unit supply points. Special equipment, special or increased rations, clothing, and forage for animals pose additional supply problems which are analyzed in detail and resolved during the formulation of landing force plans.

(2) Medical Support.--Special equipment and training are normally required for medical units. Evacuation requires additional manpower and may have to be supplied by uncommitted units. The use of ropes and cableways for evacuation lessens the burden, but necessitates training in special techniques. Helicopter evacuation is especially needed in mountains. However, altitude, terrain, and weather impose limitations upon helicopter operations.

(3) Transportation.--Transportation is restricted by the limited number and reduced trafficability of available road nets. Vehicles are used as far forward as possible, then supplies are moved forward on animals or porters in steeper, more inaccessible country. Ground transport is supplemented by aircraft when local flying conditions permit.

(4) Maintenance of Equipment.--Rugged terrain and severe climatic conditions produce more rapid wear and tear on equipment than normal environmental conditions. Weapons, radio sets, and other items are susceptible to damage while being transported or carried. Maintenance of equipment, including replacement and evacuation of inoperative items in nearly inaccessible terrain, presents enormous problems. Special emphasis is given to preventive maintenance by using units. Effective maintenance

supervision by all leaders and commanders, particularly by those at lower levels of command, is essential.

3105. AMPHIBIOUS CONSIDERATIONS

When a landing force is able to land on the coastal plain which fronts most major mountain ranges, the amphibious landing is normal in most respects. However, where mountains rise directly from the sea, as in the case of the Norwegian coast and in certain areas surrounding the Mediterranean Sea, the commander must compensate for the effects this operational environment exerts on the amphibious landing and on subsequent tactical operations ashore. Fiords and estuaries can be the focal points for such amphibious landings. Basic considerations which require examination prior to launching an amphibious assault against a mountainous coast include:

a. Determination of Beachhead and Landing Areas.--The straight shoreline is the exception in a mountain environment. There is a wide choice of convex beaches, concave beaches, estuaries, and fiords from which to choose a suitable landing area. Deep offshore water and a steep underwater beach gradient are common. The width and depth of the beach is usually narrow. Beaches fronting the open sea are subject to currents, winds, and heavy surf. However, it may be possible for large transports to anchor close to shore, even in estuaries and fiords. Beaches normally will not support the logistic requirements of large forces. This may require the landing force to land over multiple beaches. In this respect, it is undesirable to split the attack between opposite shores of a river or fiord. Amphibious helicopterborne forces are suited for landing in this terrain. These forces are followed by waterborne forces once the helicopterborne forces have secured the heights overlooking the beaches.

b. Selection of Tentative Date and Hour of Landing.--Since the landing of helicopterborne forces is a major consideration and night operations in mountains are limited, a night amphibious landing in such terrain is limited to small size raiding forces. Other major considerations affecting the date and hour of landing are the geographical location and the prevailing weather conditions in the objective area. Cloud cover, fog, temperature, and valley or offshore winds influence the selection of the time of landing.

c. Assault Landing.--Where mountain formations rise directly from the shore, beaches tend to be narrow, exits are limited or virtually nonexistent, maneuver room is severely restricted, and sharply rising natural obstacles seriously impede the initial momentum of the amphibious assault. If such terrain is occupied in force, the enemy can place direct fire across the beaches and to seaward from the heights above, placing landing craft and ships in an extremely vulnerable position. Naval gunfire renders such a defense vulnerable. Heights above the beaches may be seized by helicopterborne forces in order to cover the waterborne deployment of other landing force units. When this is impracticable, the enemy's capabilities to cover the landing beaches are neutralized by conventional and/or nuclear fires. Once initial objectives have been secured, the ship-to-shore movement of the balance of the landing force tends to extend over a more protracted period than is the case in normal terrain. The severe restrictions imposed by mountainous terrain necessitates delaying the landing of additional landing force elements until sufficient exits are cleared and space is available for deployment and maneuver. Assault elements may have to

move considerable distances inland before adequate space for the logistic support area can be uncovered. This problem can be alleviated to a degree through the realistic assignment of landing priorities, by placing increased reliance on arrangements for the on-call landing of selected units if and when they are urgently required, and by providing for interim logistic support from ships at sea, floating dumps, and helicopter delivery and evacuation.

d. Subsidiary Landing

(1) Subsidiary landings may be required in estuaries or fiords to neutralize the bank opposite the main landing. In order to have a secure, protected anchorage, both banks should be cleared.

(2) Since ground mobility is restricted ashore, subsidiary landings along the mountainous coast provide flexibility by using the ocean as a highway.

e. Seabasing.--A seabased landing force operation is an operation that is launched, controlled, coordinated, and/or supported principally from the sea. The greater reliance on helicopters and VTOL aircraft can free the landing force from its dependence on beaches, roads, requirements for logistic support areas, airfields, and the present use of rear areas and base structures ashore. The difficulties of operating in the mountainous areas described above can be greatly eliminated by application of this new technique.

Section II. SURVIVAL IN THE MOUNTAIN ENVIRONMENT

3201. GENERAL

The training of individuals in mountains of low or medium elevations does not require special conditioning or acclimatizing since the occurrence of altitude sickness is rare. When the landing force operates in altitudes of 2,500 meters or more, there is a need for a conditioning and acclimatizing period for all troops. During this period, the training program provides for gradual physical exercises, including short marches, together with appropriate rest periods. To ensure success, the area in which training is conducted should approximate conditions expected in the area of operations as closely as possible.

a. Psychological Adjustment.--The psychological adjustment of the individual Marine to the mountain environment is extremely important. Many persons who have lived at low altitudes all their lives may have preconceived notions about the supposedly harmful effects of high altitude on the human organism. To them, any abnormal complaints, however trivial, may be construed as an ill effect of altitude. Such individuals become unduly concerned about their physical condition. This can be prevented by an active educational campaign showing that high altitudes do not have many of the supposedly harmful effects and that adjustment is largely a matter of time and conditioning. Frequently, personnel transported from flat terrain approach steep slopes or cliffs with inner qualms and a sense of insecurity. They are slowly introduced to them and their confidence progressively developed until they can negotiate a passage across such obstacles with assurance and ease. Men are taught various handholds and footholds, indoctrinated in the principles of mountain marching, and familiarized with pitfalls to be avoided.

b. Physical Conditioning.--Regardless of previous training and the amount of flat cross-country marching practiced, the Marine newly introduced to mountain marching finds it arduous and tiring. A new group of muscles is developed and hardened. Furthermore, a new technique of moving rhythmically is required. This conditioning is attained only through daily marches and climbs which result in increased stamina and endurance. At altitudes above approximately 2,500 meters, time must be allowed for the red blood count to increase to augment the oxygen-carrying capabilities of the blood. Simultaneously with this development, men acquire increasing self-confidence in their ability to safely negotiate terrain which they previously considered impassable.

3202. PERSONAL HYGIENE

The principles of personal hygiene and sanitation that govern the operations of troops in the lowlands are applicable in the mountains as well. The air is relatively germ-free above 4,500 meters; however, mountains of lower altitudes are in the same category as lowlands insofar as sanitary practices are concerned.

a. Water Discipline.--Strict control is exercised over all sources of water supply. Troops cannot assume that all mountain water is safe for consumption. Water discipline is emphasized since the water demand of an individual in the mountains is great, and unless closely controlled, he may

drink polluted water. Fluids are lost through respiration, perspiration, and urination. This loss must be replaced if the individual is to operate with normal efficiency.

b. Personal Habits.--Under extreme conditions of cold, there is a general tendency for the individual to permit himself to become constipated in order to avoid the inconvenience and discomfort of straddling a trench in the cold. This neglect should be discouraged by all officers and non-commissioned officers of a unit since it ultimately induces illness.

c. Personal Cleanliness.--Personal cleanliness is especially important in extreme cold. In freezing temperatures, the individual has a tendency to neglect washing because of the cold and the scarcity of water. This may result in skin infections and vermin infestation. When bathing is impossible for any extended length of time, the individual should at least examine his skin and stimulate and cleanse it as much as possible by briskly rubbing his body with a rough towel. In this way, the occurrence of skin infections may be kept at a minimum.

d. Care of the Feet.--Particular attention is devoted to the care of the feet to protect against trenchfoot and frostbite. The causative conditions for one or the other of these disturbances are prevalent throughout the entire year in high mountains. The feet are kept dry and socks and innersoles changed at least once daily. For a more detailed discussion of frostbite, see chapter 2.

3203. MOUNTAIN MALADIES

Landing force elements operating in a mountainous environment are subject to a number of mountain maladies and afflictions.

a. Mountain Sickness.--Mountain (altitude) sickness is an acute temporary illness occurring in mountains. The novice and experienced climber alike are subject to this malady in altitudes as low as 2,500 meters. The cause is usually poor physical condition or lack of acclimatization, or both. Symptoms may be headaches, nausea, vomiting, lack of appetite, insomnia, and irritability. This condition can usually be relieved by rest. In rare cases, the patient must be taken to a lower altitude.

b. Valley Disease.--Valley disease occurs when an individual acclimatized to high altitudes returns to low altitudes. It is the opposite of mountain sickness. While in the mountains, there is an abnormal increase in the number of red cells to augment the oxygen-carrying capabilities of the blood. This increased capability is not needed upon return to sea level. The resulting symptoms are lassitude, increased sweating, weight loss, headache, noises in the ears, indigestion, irritability, depression, forgetfulness, and neuralgia-like pain. One or more of these symptoms may be present at the same time. Depending on the individual, they disappear within a few days to a few weeks.

c. Glacier Lassitude.--Glacier lassitude or snow field lassitude is a transitory physical weakening condition which often assails climbers on hot days. Physical factors which produce this indisposition are hollows into which the sun beats directly, reflecting light and stagnant or excessively still air. The physiological factors which produce this feeling of

weakness are probably due to a disturbance of the circulation. This is cured by moving into areas where there are moving air currents.

d. Snowblindness.--Snowblindness is caused by failure to use dark glasses during brilliant sunshine on snow or ice. The eyes ache and are bloodshot. The treatment is application of cool, wet compresses to the eyes, and then having the patient wear a pair of dark glasses. Eye ointment relieves the burning and pain, but does not improve vision. Occasionally, it may be necessary to cover the eyes and lead the casualty out by the hand. Recovery may take 2 or 3 days.

e. Exposure.--Exposure results from loss of body heat by prolonged cooling. In the first stage, heat production is increased by shivering, which increases oxygen consumption and metabolism four to six times. Available carbohydrate reserves determine how long this phase can be extended. Below the critical temperature of 92 degrees, the victim cannot produce enough body heat to recover. In this second stage, he has a mask-like face, glassy stare, mumbling voice, and mental confusion. Blood pressure and heart rate are reduced. The victim slips rapidly into the third stage with slow, irregular heartbeat, leading to death. Treatment is aimed at supplying heat to a victim unable to generate his own. Some useful sources are prewarmed garments, sleeping bags, and hot-wrapped rocks. Perhaps a fire can be built on each side of the patient, or two persons lie beside him, all three wrapped in ponchos. Warm fluids with sugar may give relief.

3204. NAVIGATION

Navigation in the mountains is difficult. This is especially true at night and during periods of low visibility produced by dense clouds or fog around peaks or in valleys. Navigation below the timberline may also be complicated by restricted visibility. The tactical situation permitting, advantage is taken of the crests of the ridges leading to the objectives. The ridge lines facilitate direction and control. Troops operating in mountainous terrain are thoroughly trained in mapping, use of the compass, dead reckoning, and navigation.

3205. AVALANCHE CONTROL

Avalanches present hazards to landing force elements operating in mountainous terrain. Rapid accumulation of new snow is a principal cause of avalanches which occur during or shortly after storms. Ten inches of snow falling faster than an inch per hour and driven by winds of 15 miles per hour creates a dangerous situation. Avalanches can also occur during fair weather when there are strong winds, surface melting due to the heat of the sun, and deep thawing due to rain or prolonged warm temperatures. Heavy snow in strong winds is always dangerous as it promotes slab formation. Rapidly rising temperatures with or without sunlight can cause wet surface slides or damp slab avalanches. Above freezing temperatures for 36 hours or more can cause large wet slides. Heavy rain has the same effect. In addition, rain adds considerable weight to snow, and this is very dangerous. Avalanche hazards may be minimized through careful route selection, timing, observation, and appropriate defensive measures.

a. Route Selection.--Troops are trained to recognize avalanche paths and interpret prevailing winds and recent storm data. Hazardous slopes are detoured. Doubtful slopes are traveled by one man at a time. Troops travel as high as practicable and as far from the out-run as

possible. The crest of a ridge is a safe route. Cornices are avoided. When necessary, troops cross under a cornice and travel directly underneath it. Trails across heavy timber, rock outcrops, windbeaten slopes, and terrain barriers offer considerable protection.

b. Timing.--Landing force units seek shelter during severe storms and afterward until snow has time to slide or settle. However, travel is normally possible during the first few hours of a storm. This time is used to get out of avalanche terrain. In spring avalanche weather, the period between 10 a.m. and sundown is the most dangerous. The early morning hours before sunup are the safest.

c. Observation and Testing.--Troops continually test snow conditions as they travel. Before moving across a big slope, a test movement is made on a small slope of the same angle and exposure. When possible, a cornice above the slope is cut off, or boulders are dropped on it to test snow conditions. A few grenades thrown out onto the slope offer a good test. When the path of an avalanche can be seen on one slope, adjacent slopes should be considered avalanche hazards. Attention to shadows is important. Short of a mortar bombardment, the best test is the climber himself. When an avalanche-prone slope must be crossed, one member of the party is designated to test it while belayed on a rope from another member. A well-belayed person can find out a good deal by deliberate attemps to avalanche a suspected slope. Once the slope is tested, troops cross rapidly, one at a time. Bindings and straps are loosened to permit a quick jettison of gear and all clothing is buttoned, including parka hoods.

d. Self-Defense.--When a hazardous area must be crossed, individuals are designated to test it, protected by belay ropes and avalanche cords. All personnel observe each test. Once the slope is tested, troops cross rapidly, one at a time. All clothing is buttoned, including parka hoods. Troops are cautioned to be alert at all times.

3206. MOVEMENTS AND MARCHES

Marines who have acquired the proper technique for marching in mountains are capable of marching much greather distances than untrained troops. The prime consideration is to conserve the individual's strength and combat efficiency. The properly trained individual acquires a steady rhythmic pace, decreasing in speed with the steepness of the slope. When climbing, the length of the regular pace is maintained, the feet are kept flat, and obstacles are avoided by bypassing rather than climbing over them. Use of the balls of the feet alone is avoided. The knees are locked with each step, and footholds selected carefully. When traversing steep slopes on soft ground, it is often necessary to kick footholds and to take advantage of natural flat hummocks. When traversing steep slopes on hard ground, the feet should be flat, and the ankles rolled with the slope. Logs, sticks, or small rocks are avoided. When ascending steep slopes, the rate may vary from 40 to 85 steps per minute, depending upon the altitude. Over uneven or difficult footing, a 2-meter distance between men allows the individual to adjust the length of his stride and to keep moving without being forced to halt to avoid hitting the man ahead.

a. Effects of Marching.--Improper pace or cadence in marching uphill tires troops quickly. Improper descending procedures continually jar the body causing great muscular fatigue. These effects are increased by

the weight of the pack and results in strain on the legs, pelvis, spinal column, heart, and lungs.

b. Rate of March.--The rate of march is seldom calculated exactly. To estimate the time required to cover a given distance, add 1 hour for each 310 meters of ascent or 455 meters of descent to the time required for marching the map distance. For example, a normal 16-kilometer march on a hard-surfaced road requires 4 hours. (If there is a total climb of 620 meters and a total descent of 455 meters, the 16-kilometer march should be completed in 7 hours.) For this reason, time is emphasized over distance when considering troop movements. It is normal to express distance in terms of the time required to cover it since lateral distances are often meaningless in this context.

c. March Discipline.--March discipline is rigidly enforced. If a man is forced to stop, he immediately falls out of the column. He does not try to regain his place until the next halt. All commanders give detailed attention to keeping marching formations closed to proper intervals. Ordinarily, this is accomplished at halts. Straggling is not tolerated. Taking short cuts is forbidden.

d. Pacesetting and Halts

(1) The march unit is normally the company rather than the battalion. The march unit commander maintains the pace. The pace of the column is governed by the most heavily loaded element. It is advisable to make a 5-minute halt to adjust clothing and equipment after the first 15 minutes of marching. Halts thereafter will depend largely on the steepness of the slope, altitude, and condition of the troops. When climbing steep pitches at altitudes in excess of 2,000 meters, frequent stand-up halts of about 1-minute duration are beneficial. By taking long, deep breaths, oxygen is more quickly restored to all parts of the body and strength returns at a faster rate. During regular halts, men remove their packs and weapons. Lying down with the feet elevated helps to refresh the legs and prevent stiffness. Troops are trained to clear the trail immediately at all halts to allow messengers to move along the column and stragglers to return to their place in the column.

(2) Troops should not routinely march for an hour and then take a 10-minute break. Regardless of the level of training or physical conditioning of the men, unscheduled breaks to fit the terrain and the tactical situation are preferable. For example, the steepness of a slope will regulate the amount of breaks necessary. Troops may walk for 1 minute, 10 minutes, or 40 minutes and then take a short break for half a minute, 1 minute, or 5 minutes. The troops do not sit down nor do they take off their packs or gear. They relax and catch their breath. The troops should remain on their feet and take long, deep breaths. The distance covered and the steepness of the terrain will dictate when longer halts are required. For example, a column may march for 1½ hours with several periodic short breaks, then stop and take a long 15-minute break.

e. Column Length.--When a narrow trail necessitates marching in single file, the length of a rifle company may approximate 1 mile. The difference in elevation between head and tail may be more than 1,240 meters. On a winding ascent, the trail distance between the point and the main body may be 1,800 meters, although the cross-country distance may be only a few yards. Under such conditions, the main body may be

closer to the enemy than the point and may be fired upon at the same time as the point or even before the point is engaged.

f. Selection of Routes.--Selection of a route of march is made on the basis of ease in marching as well as tactical security. Factors governing the selection of ridge routes are the availability of good footing, relative ease of contour travel, location of timber lines, and geological formations such as ledges. Primitive trails are usually found along ridges. Highways usually follow the valleys. Movement down a valley without security on the high ground invites ambush. Movement on the crest of a ridge, where some of the best trails are found advertises movements and invites enemy fire. Timing and planning are important in order to avoid halts or bivouacs on exposed terrain.

g. Selection of Objectives.--Time and distance required to reach destinations are invariably underestimated because of the optical illusion created by clear air, and the perspective gained when looking down from heights and across intervening depressions. Particular care is taken to select objectives which can be reached within the time available. Primary and alternate routes to the destination are normally reconnoitered by aircraft before and during the move. An unexpected extension of a march often produces undue exhaustion and results in a late arrival, a poorly prepared bivouac, and insufficient security.

h. Movement Over Difficult Terrain.--Movement over extremely difficult terrain such as cliffs, rocky crags, ravines, glaciers, or deep snow requires special preparations, training, techniques, and equipment. On steep slopes, columns of pack animals are not permitted to get off the trails. Foot troops negotiate such slopes by traversing or zigzagging.

i. Night Marches.--When contact with the enemy is imminent or has been gained, most marches are conducted at night. Such marches are very difficult, often dangerous, and excessively tiring. Daylight reconnaissance and marking of routes, as well as competent guides, are essential to the success of a night march. Distances between men, animals, and units are decreased. While bright moonlight makes a night march easier, it also improves enemy observation. It is extremely difficult to move along a rocky path at night without noise. Dislodging of a single rock may start a landslide that can be heard over a mile away. Shoes of pack animals and hobnailed shoes create telltale sparks. When marching through woods or areas where trails are many and indistinct, numerous connecting files are required between march units in order to maintain continuous contact. It is usually impossible for anyone to move up or down a column on a mountain path at night to check on distances and maintain march discipline. All orders are relayed backward and forward through the column.

j. Marches in Clouds or Fog.--Marches in clouds or fog present some of the same difficulties as night marches. Keeping a sense of direction is difficult since clouds are often so dense that one can hardly see the ground. Such conditions necessitate close columns, a slow pace, and the use of audible signals. The crowding together of units may cause serious tactical disadvantages when the fog or cloud lifts.

3207. SECURITY

Mountainous terrain offers many vantage points for enemy observation and ambush. It places special emphasis on security. Commanding

ground is occupied immediately by security detachments strong enough to hold it against hostile combat reconnaissance patrols. Enemy positions that are not readily accessible to friendly troops without undue loss of time may have to be neutralized by air attack, artillery, or infantry heavy weapons so as not to impede the progress of the main body. When opposed by well-trained and aggressive enemy mountain troops, NO MOUNTAIN RANGES OR TERRAIN OBSTACLES CAN BE CONSIDERED AS INSURMOUNTABLE. Every conceivable approach is guarded. The nature of the terrain and network of communications may force the enemy to concentrate his forces. At night, enemy infiltration is a constant danger, especially for rear area installations. The use of additional troops is sometimes necessary in order to adequately protect these installations.

a. Listening Posts.--A man's voice in a valley frequently can be heard on ridges 3,000 feet above. Consequently, valley approaches as well as ridge approaches are often covered by listening posts high upon ridges. However, thorough coverage of a valley approach may also require listening posts located in the valley.

b. Flank Security.--Because of the great amount of time normally required for flank security forces to reach and occupy dominant terrain features, they move well in advance of the main body. When practicable, they are moved by helicoper. In the winter, highly trained ski troops may be used for such missions. If the sides of a valley are very steep and rise 910 to 1,240 meters from the valley floor, the strength and number of flank guards and patrols and the number of reconnaissance patrols and air observers are increased. Commanders consider the physical limitations which the terrain imposes along the route selected for any security detachment. Communications between security elements and the main body, often impossible except by radio, is another limiting factor. Roads and trails paralleling the route of the main body are seldom available. Therefore, the movement of patrols across country over rough and difficult terrain is slow and fatiguing. Fixed flank units may be dispatched to occupy vantage points along the route of march.

3208. BIVOUACS

Most mountainous regions offer few camp sites suitable for large elements of the landing force. The limited number of areas and the increased lengths of columns usually require battalions, companies, or platoons to bivouac separately at the nearest suitable spot to the halting point. The search for suitable bivouac sites must commence while ample daylight remains, rather than struggling on until last strength and last light vanish together. After first considering security, priority is given to protection from the weather.

a. Formations.--The company bivouacs in any formation suitable for perimeter defense. When suitable concealment is available, the company bivouacs astride the road or trail being used with trails made for flank platoons. The use of platoon bivouacs reduces the time required to close up at night and to move out in the morning. The battalion commander, when issuing his order to halt, indicates whether the battalion is to close into platoon or company bivouacs, depending on the density of cover, the length of the column, and his mission the following day. The actual setup of bivouacs varies considerably due to the irregularities of the terrain. Living conditions are continually improved if the same area is to be used for more than one night. Temporary shelters may be improvised by

digging into the side of a slope or using shelter halves or pieces of canvas covered with grass or branches for roofing. In a stable situation, bombproof caverns are blasted out of bedrock and used for supply storage and quarters.

b. Precautions.--Smoke from a fire in a valley often rises in a column that can be seen for several miles. Lights at night can be seen from distant peaks. Exposed lights or fires are not permitted. The reflection of a meat can in a mess line can expose an otherwise well-concealed bivouac. The outside of all mess gear is blackened. No equipment which reflects light is exposed. During summer months, tents, equipment, and supplies are not placed too close to dried-up stream beds; sudden rainstorms and cloudbursts can turn the beds into raging torrents. Bivouacs are not placed where rockfalls or avalanches threaten them. Troops are cautioned against laying gear on the ground. Even during summer months, local storms are not uncommon, and valuable time may be lost searching for items buried in just 4 inches of snow.

3209. TRAINING PROGRAM

a. General.--Training for mountain operations requires detailed planning. The physical strain on troops and commanders is much greater than in lowland operations. The ruggedness of the training area should approximate that of the planned area of operation as closely as possible. If possible, a well-organized military mountaineering school is the best means for training the landing force for a mountain campaign. Instructors should be carefully selected personnel who have had previous military or civilian climbing/skiing experience. When feasible, the training period is long enough to enable the Marine to acquire the necessary techniques, to practice them, and to become thoroughly conditioned to the mountain environment. The actual duration of the training program naturally depends largely on the time available before deployment. Another variable is whether the landing force must prepare for winter as well as summer operations. Training should be continuous, as vigorous and difficult as conditions permit, and uninterrupted for best results. Ideally, training for mountain operations is carried out in three phases:

(1) Phase I.--Advanced individual training for combat assault climbers/ski-mountaineers.

(2) Phase II.--Individual training in basic mountaineering for combat, combat support, and selected combat service support units.

(3) Phase III.--Unit/combined arms training.

b. Purpose.--Irrespective of wide differences between winter and summer training programs, both have identical purpose, restoring lost mobility in the mountains. Specifically, the program should be aimed at:

(1) Providing a small number of highly trained individuals from each company/battery who would serve as assault climbers/ski-mountaineers.

(2) Qualifying the balance of the landing force as semi-trained climbers/ski-mountainers.

(3) Conditioning all hands to meet the hardship and privations imposed by rugged mountain terrain and severe weather.

(4) Developing the highest standards of initiative and self-reliance on the part of subordinate commanders.

c. Selection of Personnel for Phase I Training.--Personnel selected from the landing force for Phase I training should be a cross-section of junior officer and noncommissioned officer volunteers, who understand what they are undertaking. Preliminary screening of prospective students for mental as well as physical aptitude is mandatory. Selectees must demonstrate reasonable athletic ability, resourcefulness, and no fear of heights.

d. Training Schedule.--Sample schedules for individual and unit mountaineering training for winter and summer operations are contained in FM 31-71, Northern Operations, and FM 31-72, Mountain Operations.

(1) Phase I.--Phase I training is designed to qualify a small number of the landing force for duties as tactical assault climbers/ski-mountaineers. Each company/battery should have a minimum of six highly trained military mountaineers. Instruction would start with basic mountaineering and encompass advanced technical climbing and/or skiing skills. Emphasis is given to those skills needed for leading units over snow, ice, and rock. Marines who successfully graduate from Phase I training perform duties as assistant instructors when elements of the landing force undertake Phase II training.

(2) Phase II.--Phase II training is oriented toward developing confidence and resourcefulness at the individual level. Each member of the landing force must know that by learning these skills he is able to overcome potential hardships and negotiate rugged, precipitous terrain. Highest priority is given to acclimatization and increasing the stamina of each individual. Training is not complete until the unit commander knows how all his men will react to exposure to height and to out-of-the-ordinary muscular effort. Subjects given close attention in this phase include:

(a) Mountain walking and route selection.

(b) Backpacking.

(c) Use, care, and preservation of rope.

(d) Tree climbing/skiing.

(e) Rappelling.

(f) Construction and using rope aids to climbing.

(g) Mountain evacuation techniques.

(h) Bivouacs and shelters.

(i) Navigation.

(j) Communications.

(k) Technique of fire.

(3) <u>Phase III</u>

(a) This training period provides application in control of units, troop movements, bivouacking, and tactical and logistical problems in the mountains. Unit training involves all elements of the landing force. One of the primary purposes of this training phase is to determine the equipment and weapons that can be moved by the landing force in the rugged terrain and what items of equipment will require substitution or will be left behind.

(b) Pilots require extensive training in flying under mountain conditions. Engineers are trained to construct special installations, such as vertical hauling lines and suspension traverse and aerial cableways; to operate heavy equipment in exceptionally deep snow; and to construct bridges with the resources at hand. Forward observers of artillery and mortar units require additional training in techniques of registering, adjusting, and shifting fires on targets located on steep mountain slopes. Gun crews are drilled to handle the weapons in firing positions with only limited space available. Medical personnel are trained to recognize and cure medical problems peculiar to the mountains. Vehicle drivers have to be trained to operate their vehicles on steep, winding roads often covered by ice. Personnel must be found and trained for handling pack animals.

Section III. TACTICS AND TECHNIQUES

3301. TACTICAL PRINCIPLES

Standard infantry tactics are applicable in mountain operations. However, the ruggedness of terrain, seasonal conditions, and weather require the landing force to modify the application of basic tactical principles to some extent. A checklist of tactical considerations in mountain operations is presented in appendix E.

a. Objective.--Except in those cases where mountains are deliberately selected for their obstacle effect; i.e., antimechanized or barrier operations, the objective of the landing force in a mountain operation is to get clear of the mountainous terrain as rapidly as possible. The landing force does not normally undertake mountain operations if its objective can be achieved more rapidly by other means.

b. Mobility.--Conditions in mountain areas make ground mobility difficult. The landing force overcomes these mountain conditions by foresight in planning. Accordingly, the object of training, organization, and logistics in mountain operations is to produce mobility. Since mobility is a relative term, a secondary consideration in mountain operations is to reduce the mobility of the enemy. In striving for mobility superior to that of the enemy, the utilization of tactical aircraft and helicopters may be a decisive factor.

(1) Motor Transport.--Motor transport mobility is maintained as long as possible. Once it is abandoned, the force's speed becomes that of a Marine walking. Special vehicles can meet some of the requirements of a mountain campaign. Additional training is essential to maintain the standards of driving demanded by mountain operations. (See app. D.)

(2) Animal Transport.--When it is no longer possible to use motor transport, animal transport may be provided. To maintain the speed of operations, animals are brought as far forward as possible by motor transport. They are trained for mountain operations and are battle indoctrinated. Troops are trained in their care and in loading and leading them. It is not practical to take animals into deep snow before snow roads have been made or on expeditions where the only water is obtained by melting snow. Animal transportation is both conspicuous and vulnerable. Eventually, loads have to be carried by men.

(3) Porter Transport.--When available, indigenous personnel may be employed as porters. For a short time and with a resultant loss in combat effectiveness, porters may be made available from elements of the landing force. Usually, they are assigned from reserve units.

c. Cooperation/Coordination.--Intimate cooperation between, and coordination of, supporting arms and services is important in mountain operations. The natural difficulties of movement, deployment, and observation make this cooperation/coordination difficult. Landing force elements are trained to rely on their own resources to a far greater degree than in other types of terrain. Control tends to be decentralized. The mountains break up battles into a series of small actions often fought by isolated elements of the landing force.

d. Mass.--Mountainous terrain makes the concentration of landing force elements difficult to attain. Foresight in planning and adequate control of all phases of the operation are necessary. Much depends upon the seizure of lateral routes.

e. Security.--Success in mountain operations depends upon the correct application of the principle of security. The degree of mobility and concentration it is possible to attain is in proportion to the degree of security attained on lines of communication and in logistic support areas. Mountains offer ideal areas for tactics of infiltration and for raids or ambushes. This problem becomes more serious when the area is occupied by a hostile population. In such circumstances, complete domination of the area of operations through active reconnaissance, surveillance, aggressive patrolling, and the proper application of the principle of economy of force to security tasks is required. Otherwise, these tasks absorb too many of the landing force's combat resources.

f. Surprise.--In mountain operations, limited routes of movement, their obvious nature, and the facilities for long-range observation from high ground make the attainment of surprise more difficult than in normal terrain. Mobility, particularly the mobility provided by aircraft and helicopters, and deployment during periods of darkness and/or reduced visibility assist in overcoming these difficulties.

g. Economy of Force.--Restricted facilities for movement and difficulties of deployment emphasize the necessity for economy of force. There is no place in mountain operations for tactical or logistic elements not required to play an essential role in the battle. In general, a landing force in mountain operations lightens its load. Operations are carried out by self-contained groups sufficient to achieve the immediate objective. The remainder of the force remains clear of the battle area and maintains the capability to react when required.

h. Aggressiveness.--Landing force elements engaged in mountain operations must overcome the terrain as well as the enemy. This requires a high degree of physical conditioning, stamina, and intestinal fortitude. Training for mountain operations is designed to tax the physical capabilities of all personnel to the utmost. Training develops and sustains the esprit de corps required in mountain operations.

i. Air-Ground Coordination.--Mountain country with its uncertain and violent changes in weather, its forced down and up drafts, and turbulent atmosphere makes flying difficult. Nonetheless, aircraft and helicopters are among the most valuable means available to the landing force for observation, fire support, tactical and logistic mobility, and antiair warfare operations. The decentralized operations of landing force units and the abundance of natural cover and concealment afforded by a mountain environment require that all activities of ground elements be closely coordinated with the supporting aircraft units.

j. Command and Control.--Natural difficulties imposed by mountain terrain hamper and delay the movement of landing force units. They complicate the problems of communications to such a degree that severe restrictions are placed on normal procedures for command and control. Commanders cannot personally influence the battle to the same extent as in other terrain. As a result, major consideration is given to decentralizing

control communications and communication plans and to the improvisation of duplicated communication systems. Restrictions imposed on the normal system of command and control emphasize requirements for standing operating procedures and for the highest qualities of initiative and self-reliance on the part of subordinate commanders. The objective of training for mountain operations is to attain this standard. In the absence of higher echelon control, there can be no hesitation or undue delay in gaining the object of the operation. To facilitate control of operations in mountainous areas, commanders:

(1) Centralize the initial planning.

(2) Plan the initial allocation of forces and firepower in detail since plans can be shifted later only with great difficulty.

(3) Decentralize control of operations, if necessary, to the point of having subordinate units operate as semi-independent forces.

(4) Issue mission type orders accompanied by a detailed concept of operation. Such orders are designed to give units maximum freedom of action in situations where communications and lateral contact are difficult.

(5) Use limited and shallow objectives; usually one or two are assigned to each subordinate unit.

(6) Draw boundaries to allow advancing units to follow ridge lines and trails leading to objectives.

(7) Use phased operations. When objectives are close, the details of the scheme of maneuver are developed to minimize the problem of fire support coordination.

(8) Establish CP's well forward. Radio relay stations may be lifted to mountain peaks to ensure uninterrupted communications between units.

k. Fire and Maneuver.--In mountain operations the landing force's immediate objective is to get behind the enemy, to outflank him, to mask him, and to press on.

(1) Outflanking Maneuver and Infiltration.--The approaches in mountain operations are obvious and easy to defend. Frontal attacks are costly and hazardous. They can only be avoided by rapid thrusts along routes thought to be impassable and/or weakly guarded, or by wide flanking maneuvers carried out at great speed. The attack is normally characterized by a constant and aggressive search for a quick way around or through an obstacle. Exploitative measures taken are designed to reach the enemy's communications and logistic support areas and force him to abandon his position. Success goes to the side that can move faster, persevere longer, and fight fresher than its enemy.

(2) Base of Operations.--The freedom of movement which such tactics demand, depends essentially on the provision of a base of operations and secure routes of communication. Without these, the landing force may be diverted from the attainment of its main objective and be forced into unnecessary dispersion and detachment of forces. Mountain operations

require movement from one base of operations to another and, when necessary, domination of the intervening terrain.

(3) Fire.--Once movement is opposed, effective fire power is brought to bear. This presents the problem of how to best use the ground so as to get the right weapons and their strictly limited ammunition to positions from which they can dominate the fire fight. A thorough appreciation of the capabilities of available weapons, rigid fire control procedures, and an eye for mountain country are essential requirements. Success depends on the ability of the assault elements of the landing force to deliver accurate fire and to move by the difficult routes.

l. Logistics.--The ability to fight and win in the mountains depends, to a large degree, on good logistic plans. Without such plans, neither mobility nor morale can be sustained. Faulty logistic planning brings disaster more rapidly than in normal warfare. The logistic plan supports the operation plan. For this reason, the commander landing force takes continuing action to ensure that he is thoroughly conversant with the logistic possibilities and the difficulties to be overcome. Tactical air operations are of material assistance in solving problems of logistics, particularly in the maintenance and support of isolated detachments.

3302. OFFENSIVE ACTION BY THE LANDING FORCE

Offensive actions by the landing force in mountain terrain lack the unity so characteristic of combat in rolling terrain. The configuration of the terrain tends to give the battle a piecemeal character and to divide it into isolated conflicts difficult to control by senior commanders. Subordinate unit commanders maintain the initiative within the plan and the given mission, and in accordance with the expressed intentions of the commander landing force. Offensive action is characterized in all its phases by surprise attacks and attempts at flanking maneuvers combined with frontal action on a broad front. In all offensive operations, the seizure of dominant terrain features as intermediate and final objectives is the core of the commander landing force plan. Specific efforts to capture vantage points for artillery observation are emphasized. In the attack, landing force elements ordinarily advance along ridges and high terrain features. Natural corridors of approach which are usually mined and easily defended are avoided. In this manner, the enemy may be forced to abandon strongly defended positions in the valleys and natural approaches as they are bypassed, thus opening the corridors for the use of the landing force. Peaks and ridges are generally heavily defended by the enemy. Seizing the high ground may necessitate a frontal attack. The cost of such an operation can be reduced by moving up the noses of subsidiary ridges. Restrictions imposed by the terrain usually limit the size of units employed. A battalion landing team is the largest force normally employed as a unit in the attack.

a. Orders.--The attack order emphasizes objectives and routes of advance rather than boundaries or azimuth directions of attack. Successive objectives are normally assigned. In rugged terrain, unusual and unexpected opportunities often present themselves to small unit commanders. If these advantages are rapidly and aggressively exploited, the whole action may be influenced. Small unit commanders are briefed on the overall picture and encouraged to take the initiative. Their orders are general to allow for initiative on the part of subordinates. The senior commander is quick to seize on advantages gained by subordinate units.

b. Detached Missions.--Units on independent or flanking missions are organized to accomplish their missions without additional support. Reinforcing a unit once it has been committed is often impossible because of the length of time required to move reserves. Supporting a unit by fire is often difficult and may be impossible because of intervening ridges.

c. Approach March.--In a march along a narrow ridgeline trail, the column length of a battalion may be as much as four 4 to 5 hours. When trails are available or when combat is imminent, parallel columns, a wedge formation, or a formation with a unit on each ridge and the main body in the valley may be used. In all cases, each unit separated from the main body is capable of fighting without support.

(1) Because of the time required to reconnoiter enemy positions and the constant possibility of ambush, the rule, "contact once gained should never be lost," is especially applicable.

(2) Lateral contact between adjacent units is seldom continuous, and connecting patrols or flank patrols are dispatched frequently.

d. Attack

(1) Flanking action is sometimes impossible, and units of the landing force may be required to attack frontally.

(2) Frontal daylight attacks in sectors where there are only very few and very narrow avenues of approach offer little chance of success. Such attacks are bound to be canalized and observed and meet organized fires. In addition, they are time-consuming and thus give the enemy the opportunity to shift his reserves for a counterattack. When the attack is launched quietly and stealthily at night and without preparatory fires, there is a greater chance of surprise without being exposed to observed and/or concentrated fire.

(3) Simplicity of plan is the essence of a successful night operation. Such planning provides for continuous, effective control by the commander and for alternate action in the event that unforeseen developments arise. Characteristics of night attacks in the mountains include the following:

(a) Comparative ease of maintaining direction (usually uphill).

(b) Difficulty of maintaining control.

(c) Slow movement.

(4) The attack of a very steep position is frequently made easier by the great amount of deadspace. Halts are never made on top of a ridgeline objective. The advance of units over crests is made cautiously, in a well-deployed formation. Assault elements of the landing force continue to push the enemy toward the next objective or, if halted, dig in and reorganize well forward of the ridge crest. In case of a halt to reorganize, commanders of assault elements dispatch combat patrols to maintain contact with the enemy.

(5) The crossing of a lateral valley and assault of a well-defended ridge are similar to the forcing of a river crossing. The purpose is to move a force across quickly and economically and establish a bridgehead to permit the crossing of the main body. This requires careful reconnaissance, coordination of supporting fires, and a carefully planned attack. Such an attack may be facilitated by night deployment or through the use of smoke. To move the entire force from the ridge into the valley before the next ridge has been secured is to invite disaster.

(6) Vertical envelopment by helicopterborne units may overcome an enemy's defenses which ground forces would find extremely difficult to penetrate or outflank. Preparation for a vertical envelopment in the mountains involves the same considerations as in normal terrain. Such an attack is normally more difficult in mountainous areas because of the scarcity of landing sites and the reduction in the lift capability of the helicopters.

e. Supporting Weapons

(1) Infantry heavy weapons and artillery forward observers closely follow advancing elements of the landing force to commanding ground in order to give continuous support to the attack. All infantry officers are trained to adjust the fire of supporting weapons.

(2) Because of the difficulties in ammunition resupply, standing operating procedures should provide for a percentage of field artillery and mortar ammunition to be retained for close support of the assault and for breaking up counterattacks. In addition, a fixed number of rounds should be kept in reserve to be used only on the order of the task force commander.

f. Use of Smoke.--The use of smoke in various phases of mountain operations assumes a high degree of importance. Smoke may be used in daylight frontal attacks, stream crossings, withdrawals, and for marking and identifying positions, targets, and objectives.

g. Exploitation and Pursuit

(1) Local success is exploited immediately and vigorously; e.g., by employing reserves for flanking attacks on adjacent enemy points of resistance, by seizure of enemy communication centers, and by cutting off the retreat of isolated enemy forces. Landing force artillery covers conceivable escape corridors to the limit of its range. Frequent forward displacement of artillery is time consuming unless the guns are so emplaced initially that they can be moved forward on a road parallel to the axis of advance or penetration, or helicopter support is provided. Participating aircraft, when available, are called upon to attack retreating columns in maximum strength.

(2) Attacking in mountains is difficult work, and assault elements are generally too tired to be used effectively in pursuit. For this reason, the reserve units are used in pursuit.

3303. DEFENSIVE ACTIONS BY THE LANDING FORCE

a. General.--The landing force accrues distinct advantages and some disadvantages when it is compelled to adopt the defense in mountainous terrain.

(1) Advantages.--When the landing force assumes the defense in a mountain environment, it has the following advantages:

(a) Dominant terrain provides superior observation and firing positions.

(b) Slopes and other terrain features impose difficulties on the attacker.

(c) There are zones which are either impassable or extremely difficult for the enemy to negotiate.

(d) The lack or scarcity of roads places restrictions on the enemy's use of tanks and other mechanized vehicles and renders them vulnerable.

(e) Advantages derived from the terrain may be increased to a great extent by manmade obstacles combined with long-range observed artillery fire and aerial bombardment along the attacker's route of advance. A small number of well-placed demolitions is often sufficient to stop enemy movement on a large section of the front for a considerable period of time.

(f) Mountainous terrain assists the landing force in a defensive position in deceiving the enemy as to its strength, purpose, and disposition. Although it is difficult to move reserve units, the landing force can usually accomplish such movement more rapidly than the attacker since the landing force has more intimate knowledge of the terrain, time to prepare a network of lateral trails, and its troops are ordinarily less fatigued than those of the attacking enemy.

(g) Delaying actions are particularly effective in mountains and can be accomplished by a much smaller force than is ordinarily needed. Roads and trails can easily be made impassable for a time by creating rockslides and blasting craters on the steepest slopes, in narrow passes, and in general, where obstacles cannot be bypassed or easily removed.

(2) Disadvantages.--When the landing force assumes the defense in mountainous terrain, it is confronted with the following disadvantages:

(a) The compartmentation makes it difficult or impossible for landing force fire support elements to cover the whole front or to mass all fires.

(b) It is usually difficult to maneuver centrally located reserve units to execute counterattack plans.

(c) Grazing fire is often impossible in rugged terrain.

(d) Mountains with wooded slopes, and moderately difficult cliffs, may enable the enemy to make surprise attacks at several points.

(e) Difficulty in digging necessitates a longer time for organization of positions.

(f) There is a greater possibility of being bypassed and cut off by the enemy.

b. Selection of Positions

(1) The selection of defensive positions is governed by the necessity for:

(a) Stopping the enemy at or forward of the designated area.

(b) Barring routes of penetration which the attacker may use.

(c) Ensuring that the defense can operate on interior lines.

(d) Protecting routes of communication for the defense, especially important crossroads, bridges, and lateral roads which may be used by reserve elements of the landing force.

(e) Giving adequate security to flanks and, where possible, protecting the flanks by placing them against deep ravines, vertical cliffs, or other areas difficult to penetrate.

(f) Providing security for all areas of the front, no matter how inaccessible to the enemy they may appear.

(g) Establishing an all-around defense, particularly since terrain considerations may necessitate the organization of defensive positions on successive ridges.

(h) Forming a system of mutually supporting positions which defend all key terrain features in the defensive area.

(i) Establishing lateral communications between mutually supporting groups.

(j) Establishing effective observation of all hostile approaches in order to have early information of enemy movement and troop concentrations.

(2) The use of a preponderance of automatic weapons is of greater importance in mountainous terrain than in normal defense situations. Bare ridges can often be better covered by automatic fire from an adjacent ridge than from any position on the ridge itself. Ravines are covered by mortar fire and/or blocked by antipersonnel mines, barbed wire, or other obstacles.

(3) When occupation of a forward slope subjects elements of the landing force to heavy observed fire, it may be best to leave only a combat outpost on the military crest and place the forward edge of the battle area (FEBA) on a favorable reverse slope. Such a location for the FEBA puts the enemy in an unfavorable position for observation and limits the effectiveness of his fires and maneuver. The reverse slope defense gives the defending weapons favorable positions protected from observed artillery fire. The more difficult the defense of a position, the more important it is to have active patrols well forward to discover the dispositions of enemy forces.

c. Counterattack.--Counterattacks, when launched down a descending slope, can be developed quickly with relatively little physical exertion. When the slope is under enemy observation, a deep counterattack is impracticable. When it is carried out on a reverse slope or directly behind a topographical crest immediately following a stubborn defense of the crest, it may surprise the enemy before he has been able to establish himself.

d. Withdrawal.--The usual difficulties encountered in any withdrawal are increased when such an operation is necessary in the mountains. Pursuing enemy troops can infiltrate and outflank the landing force if they advance rapidly on routes parallel to the route of withdrawal and emerge along lateral routes on the flanks or in the rear. In addition, limited trails and road nets hamper the withdrawal of equipment and supplies.

(1) When a withdrawal becomes necessary, the landing force provides delaying detachments supported by a system of obstacles to cover the most critical crossroads and lateral routes. By taking advantage of strong natural positions and by providing the detachments with a preponderance of automatic weapons, the numerical strength of such detachments may be held to a minimum.

(2) The withdrawal of the forces engaged in the various terrain compartments is closely coordinated to prevent the cutting off of some units or a sudden breakthrough by the enemy.

(3) Artillery and aircraft concentrate their fire and bombardment on points where the enemy must pass through narrow gaps or over obstacles.

3304. EMPLOYMENT OF INFANTRY ELEMENTS

a. General.--Infantry elements of the landing force play the dominant role in mountain operations. Small units are trained to be capable of operating independently or nearly so. The individual is trained to be self-reliant, dependable, and resourceful when separated from his immediate superiors. As in flat country, infantry elements of the landing force employ fire, maneuver, and shock action. However, these actions have a somewhat different application in the mountains; normally, the effect of fire is less than in average terrain; maneuver is constantly restricted; and fire support from adjacent units is not always readily available. Movement usually takes the form of individual infiltration or successive rushes by small groups for short distances.

b. Factors Affecting Infantry Weapons.--Mountainous terrain exerts the following effects on the employment of infantry weapons:

(1) The use of overhead and long range fire is increased due to the great differences in elevation and the good observation afforded.

(2) The slopes of the terrain affect range estimation. An observer looking downward from a height tends to underestimate the range; an observer looking upward from low ground tends to overestimate the range.

(3) The steepness of slopes and irregularities of terrain counteract the effect of the grazing fire of automatic weapons and limit the extent of beaten zones.

(4) The existence of a great amount of dead space gives added importance to weapons with a high angle of fire, as well as to hand grenades and rifles.

(5) The difficulties in ammunition resupply make strict fire discipline mandatory.

(6) Mutual support from one terrain feature to another is facilitated by good observation.

c. Employment of Infantry Weapons

(1) Machineguns.--In employing machineguns, frontal fires tend to become relatively more effective. Frontal fire is commonly used in mountain operations and has the advantage of being effective deep into the area where the enemy must operate. The terrain frequently permits sustained overhead fire. However, the best positions for frontal fire are often the easiest for the enemy to locate. Further, the displacement of weapons on forward slopes is difficult and dangerous. As the enemy closes in, the great amount of dead space and steep angle of fire render frontal fire less effective. Flanking fire may be delivered from ridges and valleys protected from enemy fire and observation.

(2) Mortars.--In the attack, it may be difficult to provide sufficient ammunition for all available mortars. Under such circumstances, it is frequently better to advance fewer mortars. This is usually decided in advance after considering distances from the nearest road net to mortar positions.

(3) Hand Grenades.--Hand grenades are used to great advantage in mountain operations. Close combat among rocks and cliffs reduces the effectiveness of short range rifle fire and increases the effectiveness of hand grenades, particularly when they can be thrown downhill. They are effective in wiping out machinegun nests and mopping up field fortifications. Personnel are cautioned about throwing grenades uphill in places where they are likely to roll back down on them. Grenades can be used to great advantage in close-in fighting.

(4) Rifle Grenades/Grenade Launchers.--Rifle grenades and/or grenade launchers can be very effective for covering deadspace which exists between maximum hand grenade range and minimum light mortar range. Further, they are useful in the offense when mortar fires must be lifted due to proximity of friendly troops.

(5) Rockets and Recoilless Rifles.--Rockets and recoilless rifles are readily adaptable to mountain operations. The lighter weight weapons are especially useful because of their portability. They provide a much needed capability to defeat bunkers and weapons emplacements and are readily convertible to defensive roles.

(6) Demolitions.--For most demolition work in the mountains, the procedures delineated in FM 5-25, Explosives and Demolitions, are adequate. For demolition in rocks and rock soils, normal procedures apply except that fissures are often found which have to be well-filled and tamped with earth. A fougasse made with rock and explosives can be very effective if used on routes of approach in valleys.

d. Obstacles.--Obstacles are employed by infantry elements in conjunction with the natural ruggedness of mountain terrain to deny the enemy key terrain location and to delay and impede his movement.

(1) Well-planned atomic demolition munitions or conventional demolitions at tunnels, bridges, and sidehill cuts on roads or railroads may deny key areas to the enemy for extended periods.

(2) When elements of the landing force are compelled to adopt the defense, antitank mines are generally mixed with antipersonnel mines in the comparatively narrow approaches trafficable to hostile tanks. On slopes not trafficable to tanks, antipersonnel mines are employed exclusively.

(3) Particular attention is paid to logical approaches for the enemy's foot troops. In mountainous terrain, scattered mining techniques are utilized more frequently than patterned mining techniques. In all cases, minefields are sited to canalize the enemy's approaching forces. For a detailed discussion of obstacles and mine laying and removal, see TM 5-220, Passage of Obstacles Other Than Minefields, and FM 20-32, Landmine Warfare.

3305. EMPLOYMENT OF HELICOPTERS

The helicopter is the best means at the landing force's disposal to overcome the maneuver restrictions of mountainous terrain. Properly employed, its influence on operations in such an area can be tremendous.

a. Uses.--In mountain operations, helicopters serve as transports for men and materiel. They are used for security, reconnaissance, communication, command and liaison, logistic missions, and troop movements, both tactical and administrative. (See fig. 21.)

(1) Security.--Helicopters are frequently used to land small security elements on key terrain features. These elements maintain observation over assigned areas and provide security to the landing force. The helicopter permits the commander to emplace, relieve, and move security elements rapidly and economically.

(2) Reconnaissance.--Helicopters may be employed to provide close-in reconnaissance and warning to landing force elements on the march. In stable situations they may carry out more distant aerial visual and aerial photographic missions. Helicopters are frequently employed to lift landing force personnel on reconnaissance missions.

(3) Movement of Tactical Units.--The helicopter is used to move tactical units rapidly during critical phases of mountain operations. It is of particular value in the early stages of the amphibious assault when heights overlooking the beaches are to be seized to permit the early development of combat power ashore. In subsequent operations ashore, other means of movement, such as motor transport and foot travel, are not completely disregarded. By integrating the use of these other means with the use of the helicopter, the commander landing force has considerable flexibility in maneuvering his subordinate elements.

(4) Movement of Fire Support Means.--Terrain restricts the movement of fire support means to a greater degree than it restricts the

movement and mobility of troop formations. Helicopters are capable of moving most light and medium artillery and smaller caliber weapons in precipitous mountain terrain which might otherwise be inaccessible. Supporting arms emplaced with the aid of helicopters will, in all probability, require further air support for ammunition supply. Consideration must also be given to displacement of the pieces which will again have to be moved by helicopters.

(5) Communications.--Helicopters provide an effective means of establishing and maintaining regular messenger service and of laying wire between units.

(6) Command and Liaison.--The semi-independent nature of mountain operations normally reduces the opportunity for detailed command supervision of combat actions and liaison between units. The helicopter permits the commander to move freely about the battlefield and thus be where he can exert his influence at the decisive time and place.

(7) Supply and Evacuation.--In mountain operations, the helicopter makes it possible for elements of the landing force to be resupplied with the essentials of combat faster than by other means. Lives of seriously wounded personnel may be saved by virtue of the fact that helicopters are available to lift them rapidly to hospital ships.

b. Influence of Mountains on Helicopter Operations.--Principal limitations imposed on the employment of helicopters in a mountain environment consist of altitude (air density), wind, and limited landing sites.

(1) Altitude (Air Density).--Altitude has a direct effect upon the lift capability of the helicopter. The extremes of altitude result in a decreased power-delivering capability in the engine. An analogy to this reduction can be made with the standard automobile engine which develops maximum power at low altitudes and loses power in high altitudes. There is also a reduction in the rotor blade capability to produce the desired lift as air density is reduced. The combination of loss of engine power and reduced lift capability decreases the overall load-carrying ability of the helicopter.

(2) Wind Effects in Mountains.--Strong or gusty winds may affect the maneuverability and control of helicopters. These wind effects may preclude the use of some landing sites due to turbulence or downdraft. Also, calm areas along the flight path of the helicopter may be present wherein momentary or total loss of control may occur due to the sudden changes in lift conditions.

(3) Limited Landing Sites.--The very nature of the terrain in mountains restricts commanders in selecting landing sites which would facilitate the accomplishment of their mission. This restriction of terrain means that there are generally fewer landing sites, and when available, they require much more preparation than normal terrain. Landing sites may be further limited by the effects of altitude and wind effects or a combination of both. Accordingly, special emphasis is placed on the preparation of landing sites. In many instances, it may be necessary for engineers with appropriate demolitions and power tools to rappel from helicopters down to potential landing sites.

3306. EMPLOYMENT OF ARTILLERY

In mountain operations, artillery is generally restricted to movement on roads and improved trails. Most positions are placed near roads. In mountainous areas the employment of the helicopter to move artillery units into positions that are otherwise inaccessible is of significant value to artillery units. Helicopterborne light artillery and mortars perform many of the missions formerly accomplished by pack artillery.

a. Fires.--Artillery fire is not as flexible in the mountains as in the plains country because high masks restrict the choice of firing positions. Weapons able to produce high angle trajectories are well adapted to mountain warfare. Such weapons include mortars and the 105mm, 155mm, and 8-inch howitzers. High angle fire is frequently employed to reach over masks, behind crests, and into deep valleys. (See fig. 22.) Guns, with their flat trajectories, cannot be used for effective delivery of close-in fires except in direct fire roles. Normally, guns are employed far enough back so that their range produces a steeper terminal trajectory. Impact and variable time fuzed high explosives are very effective in rocky areas, scattering stones which in themselves act as missiles. Experience has shown, however, that protracted bombardment with impact explosives on defensive positions in the mountains does not produce many enemy casualties. Artillery fires may be used to initiate rock or snow slides, to block supply routes, or to engulf enemy defenses. VT fuzes are effective, particularly

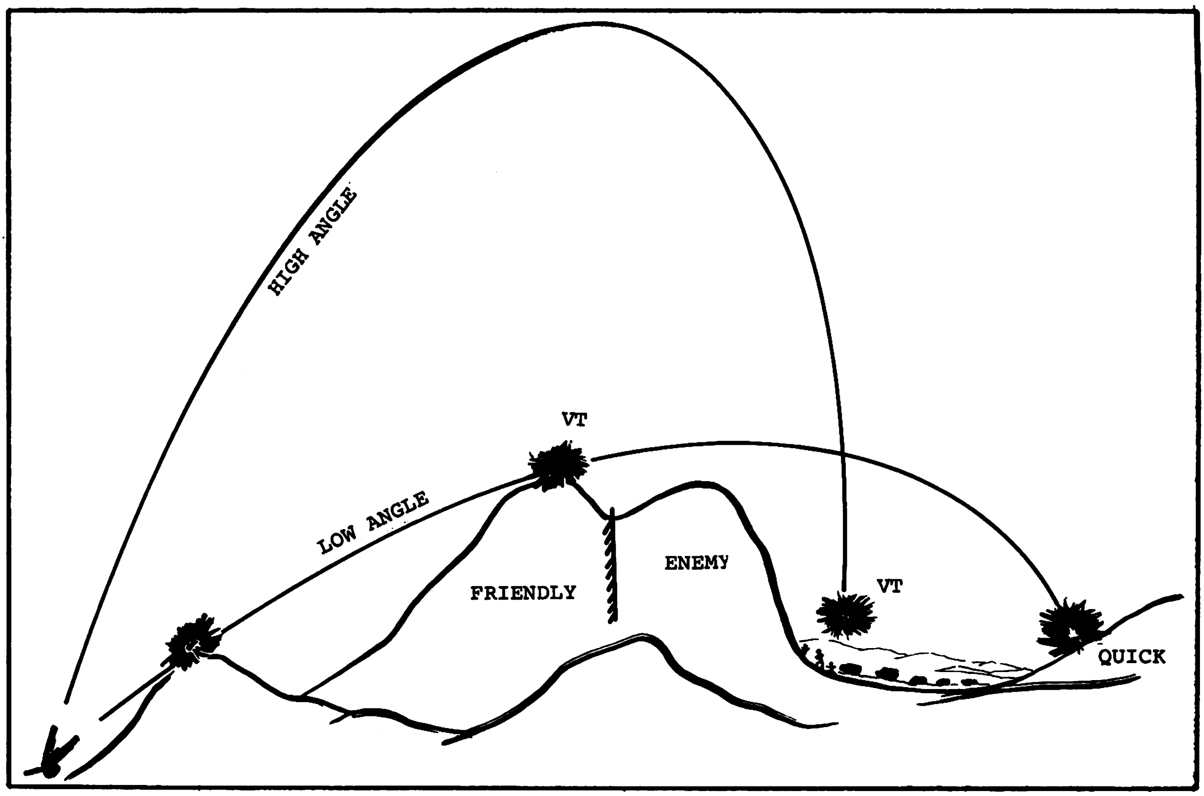


Figure 22.--Necessity for High Angle Fire.

against troops held in reserve on reverse slopes and against supply dumps, command posts, and communication centers. Smoke is used extensively but is difficult to control because of vagrant and strong winds.

b. Employment.--The employment of field artillery in mountain operations is influenced by the following considerations:

(1) Positions.--Good positions are rare in the mountains. Generally, positions are restricted to locations near the roads. Often, lack of space necessitates unorthodox occupation of positions. High ground is generally preferable for position areas since it affords reduced masks, longer ranges, and the possibility for direct fires.

(2) Observation.--Multiple observation posts are established to gain flexible dispositions at varying heights, in depth, and in breadth. Often, fog or clouds obscure one tier of observation posts but leave others open. Observation parties operating in alpine type terrain should have a minimum of two trained assault climbers within the party. Fixed-wing aircraft and helicopters increase the range of observation and permit searching of areas hidden to the ground observer. (See fig. 23.) However, the use of aircraft is limited by weather, flight hazards, and the absence of suitable landing areas.

(3) Observed and Unobserved Fires.--Adjustment of fires on targets located on peaks and reverse slopes is difficult. The great majority

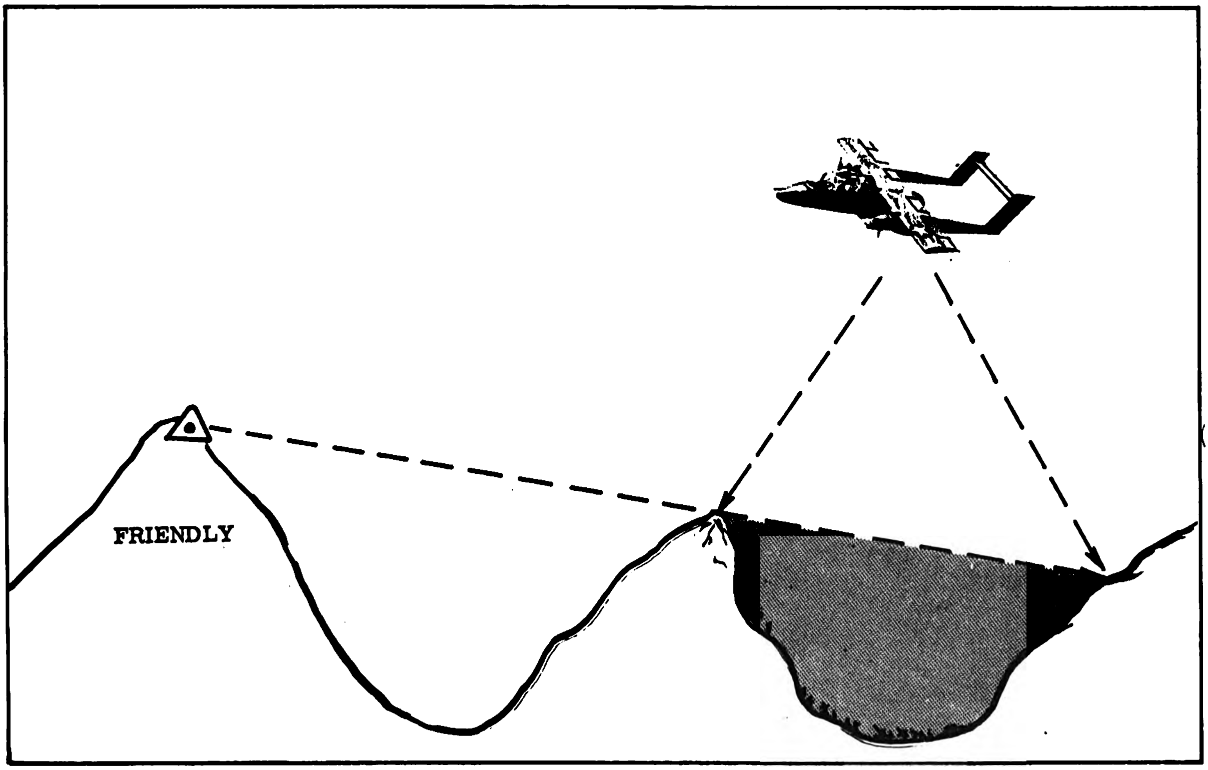


Figure 23.--Augmentation of Ground OP's With Aerial Observation.

of artillery fires in the mountains must be observed, especially close support and defensive fires. Unobserved fires are often unreliable in the mountains. Meteorological conditions change rapidly and registration corrections become invalid in short periods of time, particularly for high angle fire. Effective transfer of fire is usually difficult since altitudes within the transfer limits may vary greatly.

c. Targets.--Appropriate artillery target areas are passes and/or defiles which form bottlenecks on the enemy supply route, and areas through which hostile weapons and equipment must pass. Interdiction fire on such targets is common and normally very effective. Fire against forward slopes and crests normally produces negligible results, although artillery fire on an enemy forming up for, or executing, counterattacks in such areas can prove effective. Since the defender is usually dispersed in small groups, mass fire of many artillery pieces is unusual, expensive, and normally ineffective. The effectiveness of artillery preparations against mountain defenses which are widely separated, well-camouflaged, and protected by terrain and fortifications is normally reduced. Artillery may be more effective after the attack is launched and the enemy is reorganizing for counterattacks. Counterbattery operations are difficult, and their effects are diminished. Exaggerated defilade makes the location of enemy gun positions difficult. Sound ranging is difficult because of echoes. Radar surveillance is greatly affected by screening. Deep shadows and uneven illumination increase the problem of interpreting aerial photographs. Greater reliance is placed upon shell reports because of the inefficiency of radar and sound location in the mountains. Map and photo study is often rewarding in plotting possible enemy artillery locations, since the enemy is equally restricted in his choice of suitable gun positions.

d. Control.--Terrain compartmentation may require the use of multiple columns in the attack. This may necessitate organization of the maneuver force into small groups or forces, each requiring artillery support. It may be necessary to break up larger artillery formations to provide support for all columns. The attachment of batteries is quite common. In some cases, even sections may be attached. All units are prepared to assume the counterbattery role. General support artillery may be split to provide support for units separated by high ridges. This breaking up of artillery formations produces decentralization and some loss of control. Artillery fire plans are carefully coordinated with the infantry scheme of maneuver and with the fire plans of the infantry weapons.

e. Ammunition Supply.--Because replenishment is more difficult, care must be taken to avoid wasting ammunition on doubtful or unprofitable targets. Accordingly, targets are carefully analyzed. Area neutralization is accomplished with minimum ammunition expenditure. In addition to normal ground transport means, helicopters, air transports, pack animals, and porters may also be employed to assist in ammunition resupply.

3307. TANK EMPLOYMENT IN MOUNTAIN OPERATIONS

a. General.--Mountainous terrain normally restricts the movement of tanks to roads and trails. Tactical surprise may be achieved by employing varying degrees of engineer effort to permit tanks to move to advantageous firing positions over terrain which the enemy considers impassable. Adequate logistic support for tanks engaged in mountain operations is extremely difficult. Roads are usually few in number and require extensive

maintenance. Helicopters can assist in resupply; however, high altitudes reduce their load capacity. Mountainous terrain presents communication problems to tanks, particularly with FM sets which may be affected by high ground between stations.

b. Offensive Operations in Mountains.--Tank employment in mountainous terrain is planned in minute detail. The nature of mountainous terrain permits tanks to support attacking infantry with relatively long-range direct fire on selected areas and points. This fire support requires excellent radio communications and thorough coordination between infantry and supporting tank units.

(1) Dominating terrain features are of key importance and are normally designated as primary objectives. Attacks along low ground are usually costly because the defender normally has excellent observation. Since the route of an attacking force is usually along ridge lines and over other elevated terrain, the attacking force may gain tactical surprise. A great deal of engineer work may be necessary to enable tanks to move to positions on high ground from which they can closely support the attack. It may be necessary to build a road and install bridges in order to move from low ground to the attack position. When mountainous terrain contains corridors which are trafficable to tanks, tank units may attack down the corridor while infantry units attack along the ridge lines.

(2) Available roads and trails are kept in good repair to permit the movement of tanks. Tank dozers and bridging material are kept well forward.

(3) Only the required number of tanks needed for immediate action are taken forward. Uncommitted tanks in forward areas cause unnecessary damage to roads and may create traffic hazards for resupply vehicles.

(4) When decisive tank action becomes possible, tank units are committed, in mass, closely supported by infantry, engineers, and artillery. Objectives are usually critical points on the main communication axes.

c. Defensive and Retrograde Operations.--The fundamentals of defensive and retrograde operations are applicable to the conduct of the defense in mountain operations. The use of tanks may be limited. However, whenever possible, full advantage is made of tanks in an offensive action or in an antitank role.

3308. EMPLOYMENT OF AMPHIBIOUS VEHICLES

Employment of amphibious vehicles in mountain operations is limited by the weight and bulk of the vehicle itself as well as the difficulty of supporting an amphibious vehicle unit logistically in mountainous areas. The LVT, combat loaded, is capable of transversing a 70 percent forward grade and a 60 percent side grade. This climbing ability is intended principally to enable the vehicle to negotiate obstacles and climb hills close inshore rather than for extended operations. In mountain operations, amphibious tractors may be employed to transport troops and equipment, while armored amphibians (when available to the force) may be assigned a direct or indirect fire role. Care is exercised to ensure that roads over which the vehicles travel are passable. Tracked amphibious vehicle brakes are not built to support rapid or frequent stops. The problem of stalled

vehicles on narrow roads, which prohibit passage or turnaround of other vehicles, is guarded against, when possible, by choosing multiple routes and positioning maintenance personnel and recovery vehicles throughout the column.

3309. EMPLOYMENT OF ENGINEERS

Mountain warfare normally increases requirements for engineer support. Emphasis is placed on maintenance of routes of communications. Mountain roads and trails require extensive construction, improvement, maintenance, and repair to withstand the increased traffic and severe weather conditions. The probable lack of local material and the difficulty in operating heavy engineer equipment coupled with enemy defensive activities such as the destruction of bridges, construction of obstacles, and emplacement of mines complicate and increase the problems of maintenance and construction. Stream crossing operations can become extremely difficult and are often accomplished by expedient means. In extremely rough terrain, cableways and tramways often offer the most dependable means of supply and evacuation.

a. Positions and Facilities.--Engineers may assist in the organization of the ground and the layout of defensive positions. Obstacles and minefields are especially profitable in mountain warfare because of the difficulty encountered in bypassing or reducing these obstacles. Positions constructed in rock are strong and offer good protection but require considerable time and equipment. Other engineer missions emphasized in mountain operations include the construction of shelters, landing strips, and helicopter sites, and the supply of potable water. In order to efficiently accomplish the work assigned to them, engineers require mechanical aids such as compressors, power drills and saws, bulldozers, large amounts of explosives, and adequate transportation.

b. Engineer Reconnaissance.--Engineer reconnaissance precedes all operations but is not allowed to delay them. Rugged mountain terrain makes field reconnaissance time-consuming and dangerous. Aerial reconnaissance is emphasized, although small dismounted details may be successful. Terrain analysis for routes, trafficability, and local materials is of special importance in mountain warfare. Specially trained engineer analysts furnished with reconnaissance information and air photo coverage have the capability of furnishing information quickly and with a wealth of detail unavailable by other means. Relationships between vegetation and soil conditions resulting from terrain evaluation aid the engineer in his determination of trafficability and source of materials. Stereoplotting instruments are used to furnish contour maps, while special engineer intelligence overlays may be prepared to give information of trafficability, construction sites, and materials.

c. Road Construction.--Development of extensive road systems in mountainous regions is normally avoided. Initial plans for road nets include the improvement of existing roads and trails. Trails are normally developed or improved to initially accommodate quarter-ton trucks and, eventually, heavier vehicles. Turnouts installed every quarter mile, or less, can speed up traffic on single lane roads or trails.

(1) Roads normally follow natural contours and avoid crests of ridges. However, in mountainous areas, terrain, weather, and other overriding reasons may require the use of crestlines for roads except when the

tactical situation prevents their use. Routes are selected with special ragard to available cover and the speed with which they can be put into service. Abnormal gradients on roads may be tolerated initially to ensure that construction maintains pace with tactical operations. Routes bypass marshy spots and localities which require excessive rock blasting and movement of large boulders. Cut-and-fill type roads on slopes usually result in the best road and the most efficient employment of available equipment. When a road is to be used during the winter, plans for its location and alinement include consideration for eliminating and/or minimizing snow drifts.

(2) Advantage is taken of natural routes to reduce the amount of cutting and cribbing. Locally available timber is used for cribbing both the downhill and uphill side of the road. Air compressors and bulldozers are used to the fullest extent, although the efficiency of the compressor decreases with increased altitude. Drainage receives increased emphasis due to abnormal slopes, damaging thaws, and heavy rains. Roadbeds on a hillside are sloped downward to the inside to eliminate cross-road drainage and prevent loss of equipment over a bank as a result of skidding.

(3) In certain mountainous areas it may not be possible to make full use of normal engineer heavy equipment in road and bridge construction and in the preparation of obstacles. In such cases, reliance is placed upon hand labor and light power equipment. It is often necessary to increase the normal allotment of handtools and hand power tools and to supplement or replace construction machinery with special equipment. Substitutions and additions of equipment vary with the situation but can usually be determined by appropriate prior planning and reconnaissance.

(4) Accumulations of surface water give considerable trouble to roadbuilders. Localities where surface water is present are prepared for drainage, either by placing a culvert across the road or a heavy subcourse of large stones to allow for underground drainage. This condition is counteracted by corduroying the road with timber poles or logs. Maximum use is made of crossing or bypassing expedients which require little material. Culverts, either prefabricated or built on the spot, and fills may often be substituted for bridges. Special attention is given to snow removal during the winter months. This normally entails the use of additional engineer troops and snowplow equipment.

d. Bridges and Stream Crossing Expedients.--Standard bridges and stream crossing expedients may be used in mountain operations. Special bridges and other crossing expedients useful in mountain operations are rope crossing bridges, suspension bridges and cableways, and the Swiss bridge.

3310. EMPLOYMENT OF NUCLEAR WEAPONS

Weather and terrain are as important factors in nuclear weapons employment as they are in the employment of troop units. Extreme variations in elevation in a relatively small area combined with errors in fuzing may result either in surface or near surface bursts (with resultant problems of fallout) or in bursts which are so high above the terrain that only minor effects are achieved in the target area. Extreme and irregular terrain also alters the effects of the blast wave. Pressures on very steep forward slopes may be double those encountered on a level surface. On reverse slopes they may be only one-half those anticipated. Errors in range

or deflection, causing bursts short of desired ground zero (DGZ), may result in increased blast effect on friendly troops through canalization. Those bursts beyond DGZ may result in relatively harmless dissipation of weapon effects. Violent and erratic changes in wind direction and velocity make fallout prediction particularly difficult and unreliable.

a. Employment.--Mountain warfare permits the concentration of relatively small forces. Locating the assembly areas of units large enough to constitute a truly rewarding target for nuclear weapons is difficult. In such an environment, consideration is given to engaging small units with nuclear weapons since these units, occupying dominant terrain, may successfully defend against much larger forces and deny the use of routes of communication vital to the planned operation. Movement of delivery means into firing positions may be slow and difficult. Map data may be inaccurate or, in some cases, nonexistent. This lack of data poses many problems in the orientation of potential targets with delivery means.

b. Atomic Demolition Munitions (ADM).--Mountain terrain, in which routes of communication are normally located in defiles, presents excellent opportunities for the employment of ADM's. Physical destruction in steep-walled valleys or passes, combined with radiological contamination of debris, may be of advantage to the landing force. On the other hand, the decision to employ an ADM is evaluated in the light of the landing force's current plans and possible future operations. Indiscriminate use of weapons for barrier operations in areas where roads and routes of communication are, at best, minimal may adversely affect the landing forces' future operations. In the employment of nuclear weapons in mountainous terrain, consideration is given to the creation of avalanches which are potent weapons in themselves. Detonation of nuclear weapons may cause severe snow and rock slides many kilometers away from the point of detonation.

3311. EMPLOYMENT OF CHEMICAL MUNITIONS

Terrain and weather influence the use of toxic chemical agents in mountain areas. Prevailing winds in the area are altered by local wind currents along the valleys and by air currents up or down the mountain slopes. Prediction of the direction and extent of cloud travel is difficult and requires knowledge of local conditions.

a. Nonpersistent Chemical Attack.--Nonpersistent chemical attacks are more effective than high explosives against well dug in positions. Toxic chemical clouds can penetrate caves and bunkers.

b. Persistent Chemical Attack.--Persistent chemical attacks are made to contaminate critical targets such as fortifications, artillery, reserve positions, and command posts.

Section IV. LOGISTICS AND COMMUNICATIONS

3401. GENERAL

Logistic problems in mountain operations are directly associated with the terrain and weather. Inadequate road nets make it necessary for the landing force to modify normal logistic procedures in order to supply forward units. For example, smaller cargo vehicles (mechanical mules) are required to accomplish the tasks that are normally assigned to larger vehicles (2½-ton trucks). Ruggedness of the terrain increases maintenance problems for all vehicles employed. More extensive manpack of essential supplies is prevalent. In addition, there are areas inaccessible by roads and trails where landing force elements may have to operate. In these areas the amount of supplies that can be manpacked may be small in comparison to the amount required. In such situations, scheduled and/or emergency supply drops by cargo aircraft and helicopters are necessary. When aircraft are available and circumstances permit, they are both fast and economical in comparison to manpacked delivery. Evacuation of casualties in mountains is slower than normal with increased exposure and danger of shock. The problem of evacuation is further complicated because of the small number of walking wounded who are able to walk over the rough ground. This increases the requirement for litter bearers. Experience in the Korean War demonstrated the effectiveness of the helicopter in overcoming some of these difficulties.

3402. SUPPLY

Landing force elements operating in remote mountain areas cannot depend upon local sources of supply. Such sources are limited and provide only bare necessities for local inhabitants. When the landing force operates in this type of terrain, it depends entirely upon transported supplies. Ordinarily, three stages or means of transportation are required: vehicles wherever roads permit, aircraft and/or helicopters, and individual porters. Command is decentralized, and there is a corresponding decentralization of supply. In certain cases, supply points are necessary for servicing isolated units. The location of these supply points and the time that the various units draw their supplies are incorporated in plans, or in a rapidly changing situation, the information is furnished in fragmentary form. Careful planning by all echelons of the landing force is of the utmost necessity if supply is to function smoothly. Unless plans are carefully made, rapidly changing tactical situations cause a lengthening of supply lines. This sometimes results in a retardation of resupply or its complete interruption. To prevent such occurrences, plans are made to organize advance supply points for each tactical unit being serviced. Aerial supply and resupply can be used under various conditions, either by parachute drop, free drop, or cargo helicopters when ground supply agencies encounter terrain difficulties. The types of supplies and equipment and the methods of distribution associated with mountain operations are not especially unique. However, certain facets deserve consideration.

a. Special Clothing.--The standard field uniform or cold weather uniform, with or without inserts as seasonably appropriate, is well suited for mountain operations. Detailed information is contained in TM 10-275, *Principles and Utilization of Cold Weather Clothing and Sleeping Equipment*.

The most critical item of clothing is footgear. The increased amount of walking by all elements, coupled with the rugged terrain, places high demands on boot repair facilities and supply agencies. The combat boot provides good traction on most rock that is dry. Better footing on rock can be temporarily gained by wrapping fabrics around the boot. A few of these are burlap, canvas, rags, or an extra pair of socks pulled over the boot. Troops designated as assault climbers should be equipped with boots having rubber lug soles. The steel helmet provides adequate protection against the hazard of falling rock.

b. Special Equipment

(1) Sleeping Bags.--At altitudes of 1,500 meters and above, the mountain type bag with water repellent case is required for summer operations as well as winter. When temperatures are below 10 degrees Fahrenheit, the outer arctic bag is used for added insulation. The air mattress is also a desirable item. In addition to comfort, it provides good insulation when bivouacking on snow or rock above timberline.

(2) Rucksacks and Packboards.--The nature of mountain warfare requires each individual to bear a heavier combat load than he would normally carry in the flatlands. The mountain rucksack with metal frame and/or packboards with bags are essential items for all assault elements of the landing force. The weight that can be carried by frame rucksacks ranges from 40 to 60 pounds; heavier loads can be carried with a packboard. If rucksacks are in limited supply, priority should be given to personnel designated as assault climbers or ski-mountaineers. The weight of this pack is carried low and rests mainly on the shoulders and the middle of the hips, providing a low center of gravity most helpful when skiing or climbing steep rock.

(3) Ropes.--When the landing force is engaged in mountain operations, even in moderate mountain terrain, there is a requirement for several different types of rope.

(a) Nylon rope, 1.1 centimeters (7/16 inch) in diameter, is commonly used for climbing. This rope has a tensile strength of 4,000 pounds and is normally issued in thirty-six 1/2-meter lengths. As climbing ropes become worn or of questionable strength, they are cut into 4-meter lengths and issued to individuals as sling ropes.

(b) Manila rope, 1.9 centimeters in diameter and larger, is used for construction of various rope installations, such as vertical hauling lines, suspension traverse, and rope bridges. This rope has a strength of 4,000 to 6,000 pounds. Manila rope is preferred over nylon rope installations because it has less elasticity.

(4) Climbing Aids.--If planning estimates envision operations in alpine terrain, certain types of climbing aids should be held in limited quantities. Examples of these aids include pitons and piton hammers, ice axes, and crampons. Oval and cargo type snaplinks have multiple uses, even at lower altitudes, and should be stocked in large quantities.

c. Rations.--Every effort is made to serve B rations in mountain operations. However, circumstances may require the use of individual small detachment rations. One of the chief advantages of these rations is that they are light in weight and can be carried easily by troops or

porters. Whenever possible, these rations are eaten hot. They are prepared with small detachment cooking outfits or individual mess equipment.

d. Ammunition.--Because mountainous terrain often causes delays in supply delivery and because ammunition is such a vital commodity, ammunition distributing points are moved forward frequently and kept relatively close to the frontlines. When these movements are made, careful consideration is given to the positions of emplaced weapons.

e. Pack Animals and Porters.--Frequently, landing force units depend on pack animals, backpacking, or a combination of these means to move supplies. Mules are more suitable for mountainous terrain than horses. Loads that can be carried will vary with the animal's size, weight, condition, and the condition of the trail. As a general rule, pack loads, excluding the saddle, should not exceed 25 percent of the weight of the animal. This would mean a 600-pound animal should be capable of carrying a maximum payload of 150 pounds. In traveling through barren country, it may be necessary to carry fodder for the animal, in which case the payload must be lessened in proportion. Normally, it requires 8 pounds of oats, 8 pounds of straw, and 8 pounds of hay to maintain an average size animal for a single day. Mules can do with less for a limited time. Pack animals may have to be obtained from local sources for the organization of pack units. Indigenous labor may provide a source of backpackers and litter bearers and are organized into power units. Elements of the landing force pressed into such service usually come from reserve units.

3403. MAINTENANCE

Rugged terrain tends to cause damage to equipment carried or operated in the mountains. Vehicles and signal equipment are particularly sensitive to the terrain and climatic conditions encountered. A number of vehicles, radio sets, and heavy and bulky supporting weapons, both hand-carried and vehicular mounted, may be temporarily left behind within the combat elements because of difficulties encountered in traversing rugged terrain. Therefore, the overall requirement for maintenance of equipment in mountain warfare may be reduced because of reduction in the number of items used. On the other hand, those items that are used by the combat elements require increased maintenance and supply of spare parts. Also, the fact that units are usually operating semi-independently of their parent units and of each other, may require that service elements of the landing force be reinforced. Landing force plans for maintenance emphasize the need for placing contact repair teams with adequate spare parts well forward with the units they support to perform on-the-spot repairs whenever possible. Standing operating procedures for recovery operations of disabled equipment are established well in advance to ensure that disabled equipment and recovery operations do not block narrow mountain roads. In mountain operations, immediate action for a disabled vehicle provides for getting it off the road so that it will not impede landing force operations. The vehicle is evacuated when the tactical situation permits.

3404. MOTOR TRANSPORT

After reconnaissance of the available road net, the commander determines the type and maximum number of vehicles that can be employed by the landing force in the mountain operation. Normally, motor transportation in mountainous terrain is drastically reduced. Only those vehicles carrying loads which cannot be packed are allowed beyond the designated truckhead.

When the mountains have been crossed and the road branches out, trucks left behind are brought forward under convoy. Full advantage is taken of limited motor transport to move ammunition and rations as far forward as possible in order to reduce the high percentage of landing force personnel required for packing and man carrying.

a. Traffic Control.--Traffic control is rigidly maintained to prevent traffic congestion and delay. Responsibility for traffic control is clearly defined in all landing force units. Telephones or radios are installed to assist military police in traffic control on stretches of one-way roads. Traffic jams can be largely eliminated by constructing turnouts for single lane roads, restricting priorities to essential vehicles, preventing turnarounds except at places especially prepared and designated for that purpose, and requiring troops to march off the roads whenever practicable. Whenever vehicles pass on a narrow road, the one on the safer side moves forward only after the one on the more dangerous side pulls over as far as possible and comes to a full stop.

b. Maintenance.--Maintenance of motor transport equipment assumes unusual importance in mountain operations. Prior to and during operations in steep terrain, safety devices of all vehicles are checked. Proper adjustment of brakes is especially important. The emergency brake is adjusted so that it is capable of holding the vehicle on any slope without the aid of gears or foot brakes. Winches are checked for proper lubrication and proper adjustment of the automatic brake. Engine cooling is checked closely because of probable overheating of the engine when operating over steep terrain. For additional information on the proper care of motor transport equipment in extreme cold, see FM 31-70, Basic Cold Weather Manual, and TM 9-207, Operation and Maintenance of Ordnance Material in Cold Weather.

c. Vehicular Operation.--Operation of vehicles in mountain terrain requires that all operators be intensively trained in safe procedures for daylight and night driving and for moving on steep slopes. A checkoff list of pertinent considerations for driving in mountainous terrain is presented in appendix F to this manual.

3405. MEDICAL

The tactical situation, the nature of the terrain, and the need for rapid movement along the chain of evacuation are considered in developing landing force plans for medical support. The evacuation of wounded in mountain warfare presents special problems. In addition to the task of carrying a casualty to the nearest medical installation, there is the added difficulty of moving over rough terrain. Factors considered include:

a. The proportion of litter wounded to walking wounded is increased in mountainous terrain. Even a slightly wounded individual finds it extremely difficult to climb over the rugged terrain. Because of added exertion and increased pain, it is often necessary to transport a casualty by litter who would normally be able to return to the aid station by himself.

b. In cold weather and in high mountains, speed of evacuation is vital as there is a marked increase in the possibility of shock among battle casualties when injuries occur in extreme cold.

c. Special consideration is given to the conservation of manpower. Evacuation by helicopter is effected whenever possible. Aid stations are positioned close to frontline units. A litter team is not capable of carrying a casualty over mountainous terrain for the same distance as over flat territory. Several relay stations should be set up between frontlines and the aid station. This shortens litter hauls and speeds evacuation. In the attack, litter teams follow closely behind assaulting units.

d. Augmentation of litter teams prior to the attack greatly assists evacuation. It is important to be able to predict the number of casualties that can be evacuated with available personnel. When the average terrain grade exceeds 20 degrees, the four-man litter team is no longer efficient and is replaced by a six-man team.

e. Night evacuation is minimized. Wounded are located and evacuated during the day as many would not survive the rigors of the night on a mountain during cold weather. Night evacuation over rough terrain is generally impracticable, and the results are rarely commensurate with the effort. It is attempted only when the route has been reconnoitered, marked with tracing tape, and a rope handline installed. When routes are exposed to enemy observation and fire by day, casualties are removed from the area at night. When feasible, casualties are moved only short distances during the night. At the first point affording shelter from enemy observation and fire, a holding station is established capable of providing shelter, warmth, food, and supportive care. Casualties are brought from the forward areas to this point, held until daylight, then evacuated further to the rear.

3406. COMMUNICATIONS

a. Radio Communications.--Radio communications are frequently interrupted by mountain or tree masses. High frequency (HF) tactical AM (amplitude modulation) sets using the sky wave mode of transmission, which operate primarily between 2 and 30 megahertz, are best for mountain communications. The use of a retransmission site on the top of the mask aids high frequency sets in crossing these masks. Artillery liaison and forward observer radios are packed on packboards so that when it is necessary to move cross country, time is not lost in packing them. The satisfactory operation of radios in this terrain depends, to a great extent, on the resourcefulness and perseverance of the operators. Transmission characteristics vary depending on the time of day, ionospheric conditions, power output, and frequency of operation. The use of half-wave antennas at the proper height above ground and oriented to utilize directional characteristics is of value.

(1) Operational Procedures.--As a general rule, FM (frequency modulation) radios and AM (amplitude modulation) radios with frequency bands of 30 megahertz and higher require a line of sight transmission path between transmitter and distant receiver for best results. Increased ranges and reliability can be achieved if both radio sets are located just below the crest of mountain peaks. In the event unavoidable intervening masks exist between the terminals, it may be necessary to rely upon an intermediate retransmission site. If the transmitter and/or the receiver and its antenna are located in a deep ravine or gully or in leafy woods, reduced strength signals will result. Radio sets sited inside of rock tunnels become shielded and frequently can neither send nor receive. In situations where radio communications should normally be possible but

difficulties develop, shifting the location of the set only a few feet often improves VHF transmission and reception.

(2) Antennas.--Caution is exercised in placing antennas in mountainous terrain to obtain line-of-sight transmission. Antennas are located to avoid intervening land masks and yet so located that they are not readily observed by enemy air or ground observers. Antennas are not placed on the crest of hills or mountains unless absolutely required to obtain satisfactory communications.

(3) Care of Equipment.--Extreme and rapid changes in temperature in mountains create problems in keeping radio sets and batteries dry and at an even temperature. Battery failure, moisture, and cold are the principal causes of reduced efficiency of the standard portable radio. Radio operators carry as many extra batteries as possible. In cold weather, it is necessary to wrap radio sets in moisture-proof bags and keep them in dry places. Microphones freeze readily when moisture from breath of the operator is allowed to enter. The microphone should be protected by using a small, moisture-proof bag. On warm days, batteries are kept out of the sun.

(4) Packing Radio Sets.--Some of the heavier radio sets are broken down and carried on packboards. Drill in packing, unpacking, and setting such sets in operation is practiced until each member of the team is thoroughly familar with the packing of each part and the placing of each in its proper place. This develops speed in handling and prevents the loss of vital parts in hurried moves under difficult conditions.

(5) Air-Ground Radio Communications.--Since most air-ground communications require line of sight UHF equipment, it is often difficult to establish communications because of intervening terrain masks. However, ground plane antennas often improve poor radio communications with helicopters employing HF radios.

b. Wire Communications.--Wire communications are the most dependable in mountainous terrain. However, there are problems in installing wire communication systems because of the terrain over which the wires are laid. The installation of a wire system in mountainous areas requires careful planning and installation to ensure that the wire is protected from rock falls, landslides, severe storms, and deep snow. The uncertainty of radio communications makes it important that wire systems function continuously during displacements as well as during static situations.

(1) Wire Laying Means.--Wire is laid by vehicles of various types. The 1/4-ton truck is best suited to mountain roads and trails. When vehicles cannot be used, it may be possible to lay wire lines from reel units RL-39 or MX-306 dispensers attached to packboards. On occasion, consideration is given to laying wire by aircraft, either fixed-wing, or rotary. Kits are available for use in conjunction with aircraft in situations that require them.

(2) Selection of Routes.--Care is exercised in the selection of routes over which wire is to be laid. Roads that are used as main routes of march are avoided if possible. Wire layers use roads and trails as guides only with wire being laid at least 2 meters off to the side. When a route is impassable due to chasms or other terrain obstacles, the gaps may be crossed by using the rifle grenade or rocket launcher methods

of projecting the wire. When these methods are not successful, the wire team may have to be assisted by aircraft.

(3) Wire Laying in the Attack.--In the attack whenever practicable, wire is laid to the rear of the attacking echelons of each rifle company. This is done by using wire carrying parties equipped with dispensers mounted on packboards and with a field telephone or sound powered phone attached to the wire. This enables the company commander to contact the battalion command post as necessary or at prearranged intervals. The wire carrying party stays with the company commander so that telephone communications are immediately available to him. When objectives are secured, lateral lines are laid between companies.

(4) Wire Laying Techniques.--Care is exercised in handling and laying wire to minimize breakage and damage. On steep slopes, wire is tied and tagged frequently to prevent interruption and simplify maintenance. Shorts may occur frequently because of high winds. Where the situation warrants it, a solution to this problem is to lay two separate wire lines as conductors for one circuit several meters apart and then tie or peg down each line at regular intervals. This allows more conductors thereby increasing the transmission range and reducing the possibility of interruption of the circuit because of trouble on the line.

(5) Teletypewriter Service.--The use of teletypewriter service is feasible in mountainous areas. The equipment is portable and may sometimes function on a circuit not suitable for telephone communications.

c. Visual Signaling.--Visual signaling assumes increased importance in mountain operations. Long lines of sight present excellent opportunities for its use. Visual equipment is light and more easily carried than other communication equipment. It can be easily improvised. Observation points are almost always available.

(1) Semaphore.--It is desirable for officers, noncommissioned officers, and reconnaissance and communication personnel operating in mountains to be able to read and send semaphore.

(2) Blinker.--Blinker lights can be read at least one kilometer in clear daylight and several kilometers on clear nights. Radio operators should use the standard procedure in sending messages by blinker; prearranged message codes can be flashed by an operator who does not know the international code. Signal lamp equipment or flashlights may be used to send international code or prearranged message codes.

(3) Lamps and Flags.--Lamps and flags for visual signaling purposes may have to be improvised or procured as additional equipment. When no standard equipment is available, strips of cloth tied toward the outer end of sticks of wood or bayonets will serve for flags. For short ranges when the use of flags would be unduly conspicuous, the waving of hands, arms, or handkerchiefs may be used.

(4) Other Devices.--Under favorable conditions, the sun's rays can be caught and reflected by means of a mirror or heliograph device and used to transmit messages. Pyrotechnic devices can be used in the mountains as in normal terrain to send prearranged messages requiring immediate action or when other means of communications are uncertain or too slow. In order

to ensure transmission through mountain fog and clouds, it may be necessary to set up a chain of stations to relay pyrotechnic signals. Smoke signals can be used to attract attention or as a substitute for pyrotechnic devices. Panels are used in the mountains as in the flatlands, although difficulty may be experienced in finding a suitable panel display ground.

d. Messengers.--Messenger communications in mountains are slowed because of poor road nets and terrain obstacles. One-half kilometer per hour is considered a fair speed for trained messengers in rough, heavily wooded areas. They should be taught to depend on natural terrain features and manmade landmarks for orientation and to use wire lines as guides to command posts when they exist. In extremely rough or snow-covered terrain, messengers should be dispatched in pairs. Aerial messengers can offer some advantages where hazardous conditions caused by terrain, altitude, and associated weather do not prevent operation of aircraft.

CHAPTER 4

DESERT OPERATIONS

Section I. INTRODUCTION

4101. GENERAL

There is nothing new about fighting in the desert. Deserts provided one of the chief battlegrounds in ancient times and were the scene of major battles in World War II. The necessity for maintaining a force in readiness for the execution of amphibious operations in a desert environment is real and continuing; first, because of the strategic importance of desert areas; second, because most of the important desert areas of the world are contiguous to oceans. Doctrine for amphibious operations is applicable to desert operations, but some modifications are normally required to cope with extremes of the environment. In addition, the fluid nature of desert operations and the large geographic areas in which they are normally conducted necessitates some modification of landing force organization and equipment to provide for increased mobility, antimechanized protection, and long range reconnaissance and battlefield surveillance. This chapter is primarily concerned with delineating landing force tactics and techniques in a desert environment. For a more detailed discussion of desert operations, see FM 31-25, Desert Operations.

4102. THE WORLD'S DESERTS

There are eight principal desert areas in the world. (See figure 24.)

a. Sahara Desert.--The Sahara Desert in northern Africa covers an area of 3 1/2-million square miles. It has a great variety of terrain, all with little vegetation. Most of it is loose, shifting sand, but there are large areas of sandstone, limestone, and volcanic rock. It has salt

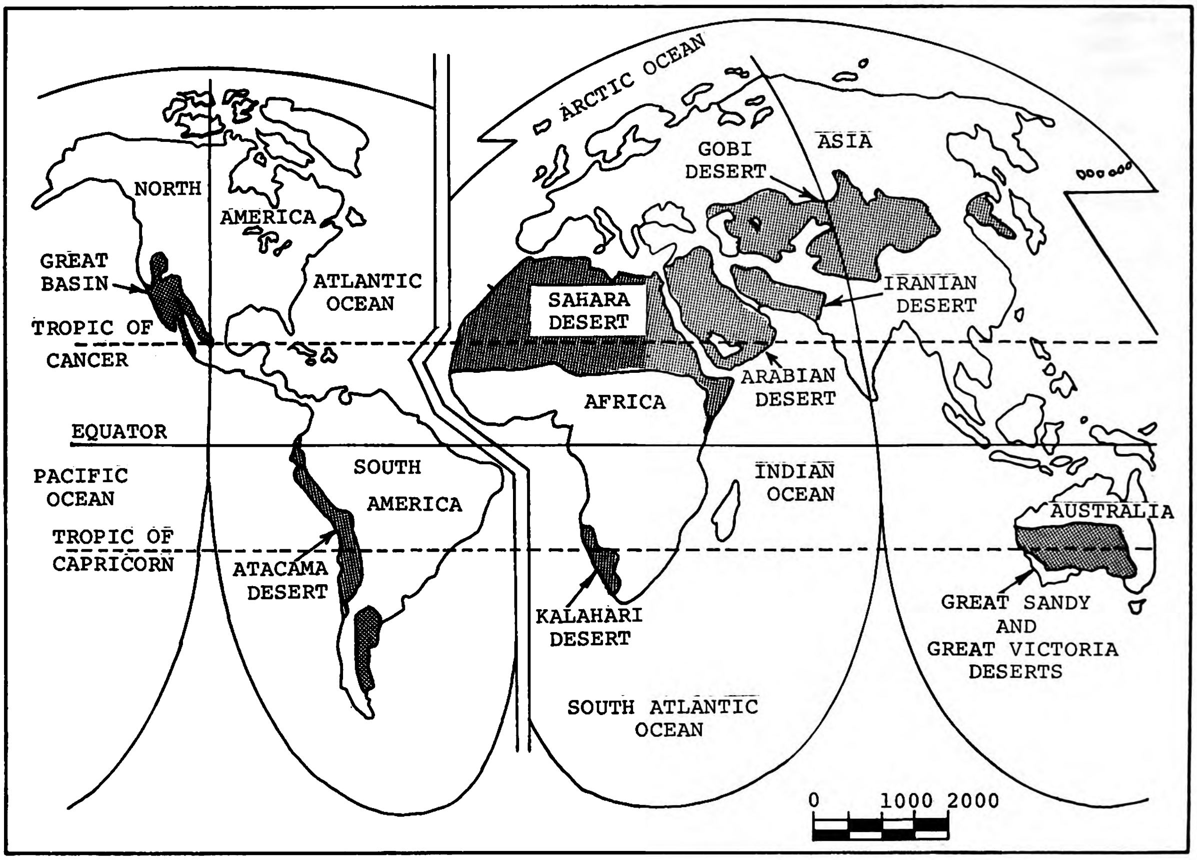


Figure 24.--Deserts of the World.

marshes, brackish mudholes, rocky escarpments, canyons, and mountains. It is swept by hot, dry winds that frequently cause severe sandstorms. Temperatures are extremely high in the daytime--up to 130 degrees Fahrenheit--but drop sharply at night. During the winter months, nights are bitter cold, often necessitating the use of blankets and the wearing of overcoats.

b. Arabian Desert.--The Arabian Desert extends over 1-million square miles in Asia Minor (Arabia, Iraq). It comes the nearest of any large desert area to being a complete waste; with great, continuous, drifting dunes and almost no vegetation except an occasional oasis. The Syrian Desert is an adjoining area to the north and may be considered part of the Arabian Desert region.

c. Iranian/Persian Desert.--The Iranian/Persian Desert extends from the Persian Gulf to the Caspian Sea. The mean elevation of this region is about 4,000 feet, and the climate is severe. Sand blows almost continuously from the north during the "wind of 100 days," with velocities up to 75 miles per hour. This desert region extends into India and southern Russia.

d. Gobi Desert.--The Gobi Desert in China is a huge, waterless area of 600,000 square miles, surrounded by high mountain barriers that cut off

rainfall. The area is nearly treeless and most of it is covered with wiry tufted grass. Elevation is between 3,000 and 5,000 feet above sea level. The Gobi has a severe climate with extreme variations in temperature during a 24-hour period.

e. Atacama Desert.--High mountain barriers deny rainfall to the Atacama Desert in Chile, Argentina, and Bolivia. It is a mountainous area 7,000 to 13,000 feet above sea level. The whole area is desolate and barren, and it is inhabited only because it is the richest mining area in South America.

f. The Great Basin.--In North America, the Great Basin contains large areas of desert comprising about 200,000 square miles in Arizona, New Mexico, Nevada, Utah, and parts of Texas, Colorado, California, and northern Mexico. Much of the terrain is rocky and mountainous, and it is cut by ravines, canyons, and escarpments. Vegetation is sparse, consisting mostly of cactus and sagebrush.

g. Kalahari Desert.--The Kalahari Desert (400,000 square miles) in the South African highlands consists of great areas of red sand and extensive flats. Most of it is covered by a heavy growth of scrub trees.

h. Australian Deserts.--The Australian deserts cover approximately 600,000 square miles. They include the Great Sandy and Great Victoria Deserts. The interiors of these deserts are practically uninhabited. Rainfall is erratic, arriving in cloudbursts once or twice a year. Storms and violent cyclones occur frequently. The area is flat and level, with occasional mountains, and contains only scrub growth.

4103. TYPES OF DESERTS

Desert areas are not uniform in character. Only a small portion of these arid regions are sandy. A much larger proportion is comprised of rocky plateaus and basins surrounded by barren mountains.

a. Mountain Deserts.--(See fig. 25.) Mountain deserts are characterized by scattered ranges of barren hills or low mountains separated by dry basins. Most of the infrequent rainfall occurs in the highlands, in violent, but infrequent, showers. This rainfall runs rapidly over the surface because of the steep slopes and erodes deep ravines and gullies. Flood waters rush from the mountains into the basins where the rate of flow is suddenly checked and most of the sand and gravel is deposited. Evaporation rapidly removes the water, resulting in dry salt flats or salt marshes. When sufficient water enters the basin to support a permanent body of water, a shallow lake such as the Great Salt Lake of Utah is formed.

b. Rocky Plateau Deserts.--Rocky plateau deserts are of relatively slight relief, interspersed in some places with extensive and sandfilled basins. The plateau is cut by dry, steep-walled valleys, the result of recurring floods. These valleys are filled from wall to wall by torrents of water during infrequent rains. An alluvium of sand and gravel is deposited; resulting in flat, sandy, or gravel ravine bottoms. These valleys are known as "wadis" in the deserts of the Middle East and as "arroyos" in the western part of the United States.

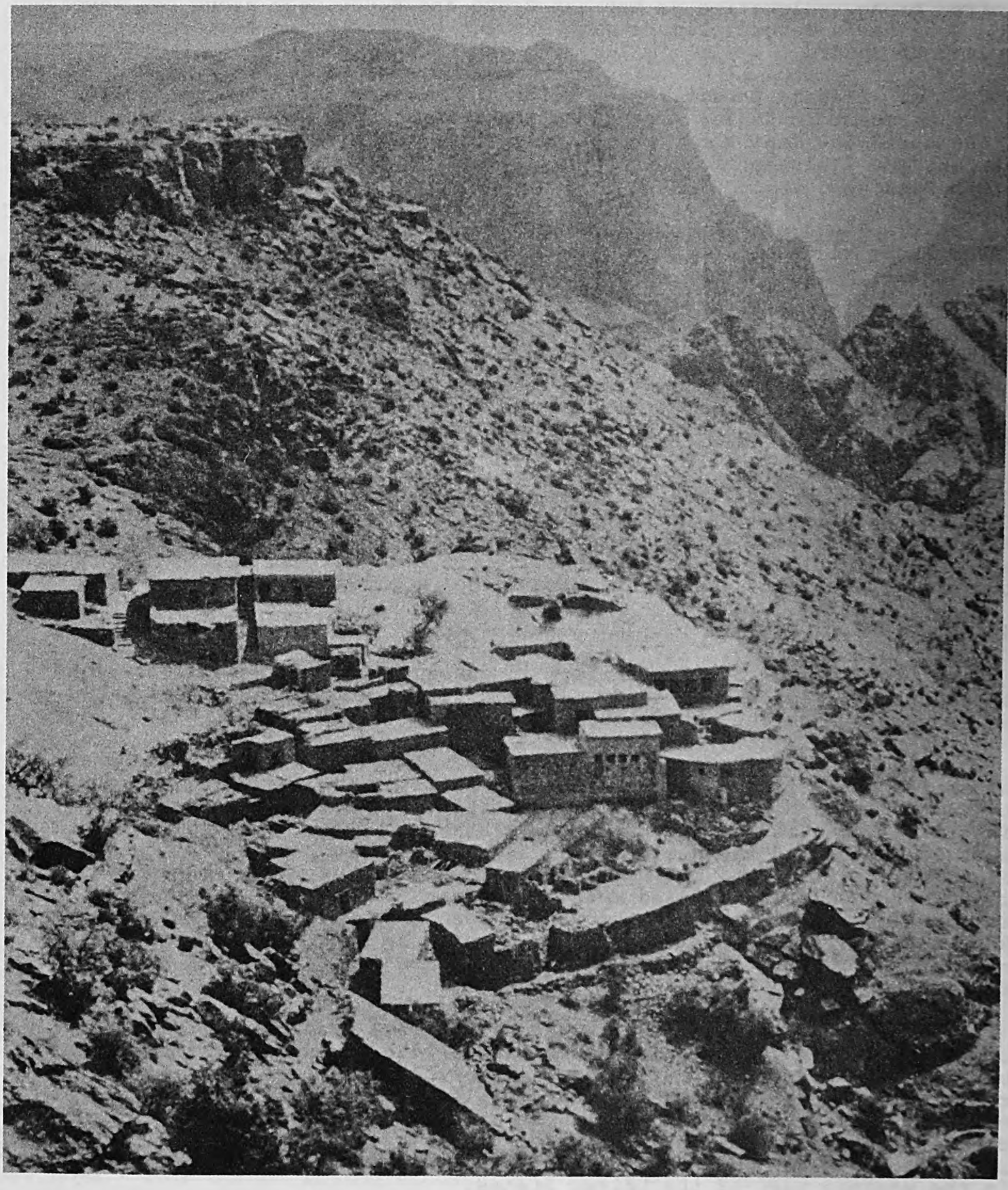


Figure 25.--Mountain-Type Desert Terrain.

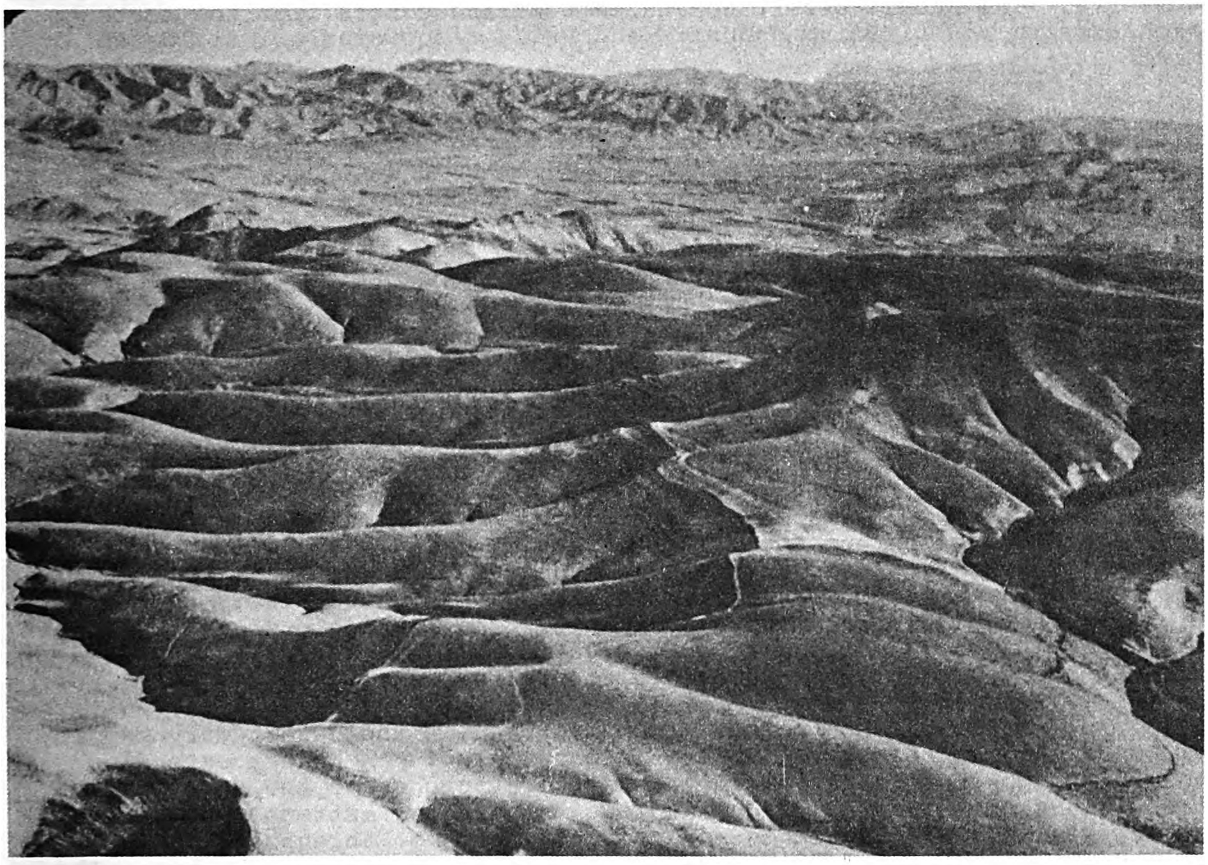


Figure 26.--Sandy Desert.

c. Sandy Deserts.--Sandy deserts are extensive basins which have become completely filled with deep, shifting sand which is the product of alluvial deposits and wind erosion. This is the "movie desert" characterized by shifting dunes and endless wastes of trackless sand. (See fig. 26.)

4104. STRATEGIC IMPORTANCE OF DESERT AREAS

Certain desert areas; i.e., the Sahara, the Arabian, and the Persian, have been the scene of armed conflicts since the beginning of time. These areas comprise the Near East whose strategic importance centers around the following:

a. The Near East dominates all land and sea routes of communication from Europe to India and the Far East.

b. The Near East dominates vital warm weather seaports that are potentially available to the U.S.S.R.

c. The Near East, primarily the Persian Desert and certain portions of the Arabian Desert, contains vast deposits of oil.

d. The Sahara Desert dominates overland routes from the north to rich uranium and titanium deposits and newly discovered oil fields in North Africa.

e. The area either contains or dominates potential strategic locations for advanced bases that might be required in countering aggression in southeastern Europe, northern Africa, and Southwest Asia. He who controls the Sahara and the Near Eastern deserts controls the Suez Canal and dominates the Dardanelles.

4105. PHYSICAL CHARACTERISTICS OF DESERTS

Desert areas, though varying in surface configuration, have certain common physical characteristics. Principal among these are:

a. Lack of Water.--The most important characteristic of the desert is the general lack of water. The population of the desert varies directly with the local availability of water.

b. Lack of Vegetation.--Vegetation in the desert is scant and specialized to withstand the rigors of desert life. Types found in any given area are closely associated with the depth of the local water table. Palm trees are a clear indication of water within 2 to 3 feet, salt grass within 6 feet, while cottonwood and willow trees indicate water at a depth of 10 to 12 feet. The common sage, greasewood, and cactus bear no relation to the water level, and are useless as indicators.

c. Extreme Temperatures.--Temperatures in the desert vary considerably according to the latitude. In portions of the desert extending toward the polar regions, as in the northern reaches of the Gobi Desert, the winters are bitterly cold. At lower altitudes, extremely high temperatures are evidenced, such as a record 134 degrees Fahrenheit in Death Valley, California, and 136 degrees Fahrenheit near Tripoli, Libya. The range of temperatures during the day in the desert is high as a result of the unobstructed, direct effect of the sun's rays. The desert night brings a rapid drop in temperatures, especially on elevated plateaus, as the surface cools quickly under the clear night skies.

d. Bright Sunshine and Moonlight.--Low cloud density results in abnormally bright conditions of light during the day and on moonlit nights. Glare may be evident during the day. The nights are generally crystal clear.

e. Duststorms.--Strong winds may raise towering dense clouds of dust and sand. This condition is more prevalent in the sandy areas, but exists to a degree in all arid or semiarid regions.

f. Mirage.--Mirages are common in all desert areas and are the result of light refraction through heated air rising from extremely hot sandy or stone surfaces. Mirages normally are manifested when the observer is looking toward the sun and tend to distort the shape of objects, particularly in the vertical dimension.

g. Rivers.--Most deserts, except those in Australia, are crossed by rivers. These rivers originate in rainy areas outside the desert and have the characteristics of lacking tributaries and of decreasing in volume downstream. Such rivers are the Euphrates in Syria and Iraq, the Colorado in the United States, and the Nile in Egypt.

4106. MILITARY ASPECTS OF DESERTS

Landing force planners consider military aspects of deserts in terms of key terrain, observation, fields of fire, cover and concealment, obstacles, and avenues of approach.

a. Key Terrain.--Key terrain features are scarce in desert areas. As a result, the landing force's mission is not normally tied to the ground but to the destruction of the enemy and his means of support.

b. Observation.--Open terrain and predominantly clear atmosphere offer good, long-range visibility in desert areas. This visibility is negated on occasion by the glare of sunlight, curtaining effect of duststorms, and the distortion of mirages and heat waves. Absence of commanding terrain frequently precludes all but short-range ground observation of the immediate area.

c. Fields of Fire.--Fields of fire for flat trajectory weapons are generally good. The slight relief of dune ridges and the rock outcroppings on the plateaus offer a degree of defilade protection. Overhead cover and concealment is relatively nonexistent, resulting in excellent target areas for artillery, naval gunfire, and mortar fire. Tactical air operations are virtually unrestricted.

d. Cover and Concealment.--Since deserts include sand dunes, hills, and mountains, there is generally a reasonable amount of cover from enemy flat trajectory fire. Concealment, on the other hand, is a problem. Scrubby vegetation offers poor concealment for troops, vehicles, and logistic support facilities. Camouflage is extensively used in desert terrain. Nets and other artificial means are required as natural materials are lacking. Camouflage measures are directed at deception rather than concealment.

e. Obstacles.--Deserts are relatively free of natural obstacles to movement. Existing obstacles normally can be bypassed; however, areas of loose sand may effectively hinder movement by wheeled vehicles.

f. Avenues of Approach.--Frequently a desert may be considered as an avenue of approach. Relief and drainage, trafficability, and vegetation have less influence in determining avenues of approach than is usual in most other areas. The landing force can move in almost any direction, and obstacles or areas of "poor going" encountered can usually be bypassed. Routes of communication are vital in considering avenues of approach. There is a scarcity of highways, railroads, and navigable waterways in the desert. Since combat in the desert necessitates the movement of landing force elements over long distances with extended lines of communication, and since the means of transportation are highly important in the supply and service aspects of desert operations, existing routes of communication assume added importance in determining the avenues of approach to be used. During World War II in North Africa, for example, the battle tended to seesaw back and forth within a relatively short distance from the coastal roads, railroads, and seaports of the Mediterranean.

4107. EFFECTS OF DESERT ON LANDING FORCE OPERATIONS

a. Lack of Water.--The size of the landing force and the extent of its operations depend on its ability to supply water by vehicle, amphibious assault bulk fuel handling systems, and other means. To maintain combat

efficiency, troops must have large quantities of water. Lack of water and subsequent dehydration lead to heat exhaustion. The problem of water supply can be lessened with proper training in the conservation of water. When necessary, rigid rationing of water is employed. Avoidance of extra exertion and the planning of heavy work so it can be done during the evening or early morning hours reduces discomfort and dehydration. Long marches are conducted using available mechanized/motorized resources or helicopters insofar as practicable. When marches are conducted on foot, they are planned so as to avoid the heat of the day. Bodily exposure to bright sun and wind is minimized in order to prevent incapacitation from sunburn and/or windburn.

b. Objectives.--Seizing and holding ground for its own sake is of little value to the landing force in the desert, unless the terrain includes communication centers, enemy bases, dominant ground, water sources, or special features such as defiles, passes, or obstacles. Tactical objectives include troop concentrations, supply trains, artillery positions, and armored bivouacs.

c. Organizational Mobility.--The vast freedom of maneuver available in the desert and the extreme hardships which the desert imposes upon foot troops generate an increased requirement for mobility for a landing force engaged in desert operations. While the effectiveness of the landing force in terms of mobility may be evaluated in terms of the relative effectiveness of the mobility of the enemy, desert operations can be most efficiently conducted when the landing force is 100 percent mobile. In providing mobility to the landing force, planners are concerned with integrating available motor transport, LVT's, tanks, self-propelled weapons, helicopters, and aircraft into a combination that will best support the landing force's scheme of maneuver ashore, and retain the flexibility to react to changing circumstances.

d. Reconnaissance and Security.--The freedom of maneuver enjoyed by ground forces in air-ground operations demands all-around security measures, together with aggressive and continuous reconnaissance. Reconnaissance is extended to the maximum limit of available means. Optimum use is made of aerial reconnaissance during conditions of favorable visibility. Aerial reconnaissance is complemented by ground reconnaissance to detect and counter small patrols and raiding parties and to provide complete protection at night or during conditions of reduced visibility. Ground patrols must be highly mobile, suitably armed, and have adequate communications. Because of the fluid nature of desert warfare, penetration or flanking of forward lines and wholesale operations in rear areas are not uncommon. All units establish strong all-around defenses whenever halted. Generally, these defenses include minefields and are strong in antitank and antiair warfare units.

e. Surprise.--Movement of landing force units in the desert is accompanied by large dust clouds, which can be seen for many miles in daylight. Aircraft can spot movement very easily. During dust or sandstorms, large elements can move without being observed, but under such conditions, control is difficult. However, with favorable winds, an attack or large movement can be made behind a sandstorm as it moves toward the enemy. At night, screened by strong security elements, large units can move great distances in comparative secrecy, while small parties harass the camps and supply trains of the enemy.

f. Camouflage.--In open desert areas where there is little or no concealment and little broken ground for cover, careful camouflage is of extreme importance. Vehicles and weapons are dispersed and, where possible, dug in. Telltale shadows are broken or disguised by camouflage nets; brush and canvas covers are used to give trucks the appearance of tanks (and vice versa). Where and when possible, noise devices can be used to assist in this deception.

g. Deception.--Deception is vital to the achievement of surprise in the desert. Deceptive measures are important during desert operations because of the lack of cover and concealment and the continuous activity of enemy air reconnaissance. An adequate deception plan at all levels of command can contribute to the deception of the enemy or at least prevent his learning the exact intentions of the landing force. Concealment of intentions is of the utmost importance in order to achieve a measure of surprise for the landing force and thus make it possible to exploit the time taken by the enemy command to react. Deceptive measures of all kinds are encouraged, if only to make the enemy commander uncertain and cause him to hesitate and hold back.

h. Air-Ground Coordination.--Coordinated action between air and ground elements of the landing force is of primary importance to the success of operations in the desert. The gaining and maintaining of air superiority to a relatively high degree is mandatory. The opportunities for influencing the landing force's scheme of maneuver by air attacks on enemy tanks, truck convoys, troop areas, supply dumps, and airfields are increased in proportion to the degree of air superiority attained.

(1) After air superiority is achieved, consideration is given to interdicting water and land approaches to the area of operations in order to cut enemy supply lines.

(2) At the same time, consideration is given to search and attack missions against enemy armor and vehicles and to close air support strikes. Aircraft are made available as cover for landing force tank or mechanized formations. In this type of air operation, the aircraft protect the tanks or mechanized formations from both tank attacks and hostile air attacks.

i. Communications.--The nature of desert warfare places a premium upon dependable communications.

(1) Large-scale operations tend to follow the means of communications, such as major roads, railroads, large rivers, and seas. In large part, normal means of communications are lacking in the desert, and those which are available are usually inadequate. There are few roads and railroads and the few towns are separated by vast areas of wasteland.

(2) Operational communications assume even greater importance than usual in desert operations. In most cases, it is easier to communicate by radio; however, there are a great many factors pertaining to overall communications which are considered.

(a) The speed, mobility, and dispersion of landing force units place a heavy burden on the communication system of a unit in the desert. Because of the speed of movement, wide dispersion of units and the requirement for being highly mobile, a unit is forced to make extensive use of radio communications. Radio relay is highly desirable.

(b) Wire is not used except in relatively stable situations. Extreme distances involved in offensive actions make the laying of wire time consuming and wasteful.

(c) Motor and air messengers are used extensively; foot messengers are used only on very short routes.

(d) The fluid nature of fighting plus wide dispersion of units, combined with physical difficulties of the desert, make unusually heavy demands on the supply system. For example, batteries deteriorate very rapidly in hot climates. Wire, when used, must cover much greater distances in almost all cases. To meet these increased requirements, a well planned supply and maintenance support system which keeps the supplies and support well forward in the battle area is required.

(e) Sand and dust adversely affect the mechanical and electrical parts of communication equipment; hence, commanders at each echelon stress maintenance. The supervision and planning given to an extensive preventive maintenance system pays dividends.

j. Logistics.--In the final analysis, logistic support determines the success or failure of desert operations. The terrain of the desert encourages a mobile or fluid type of warfare and generates increased requirements for fuel, water, and ammunition. As a result, a flexible supply system is required to provide such supplies to tactical elements when and where they need them. This may be accomplished by keeping supply installations well forward, by the mobile loading of supplies in trucks or amphibious vehicles, and by delivering supplies by helicopter or fixed-wing aircraft. The very nature of this mobile warfare imposes a particularly hard task on service and supply units. Service units have to cope with the maintenance problem caused by sand, while supply units face the task of moving large amounts of supplies long distances over trackless territory and distributing them to fast moving forces.

Section II. SURVIVAL IN THE DESERT ENVIRONMENT

4201. GENERAL

Survival is one of the basic objectives in training for an amphibious operation in a desert environment. In desert operations, the importance of overcoming the adversities of weather and terrain demands increased attention to ensure the same degree of efficiency expected under so-called "normal" battle conditions. The only practicable method to acclimatize and harden landing force personnel for desert operations is through realistic training under combat conditions in a desert environment. The training program is designed to prepare the individual Marine for desert operations psychologically and physically, as well as militarily.

a. Indoctrination.--Marines work better when they are kept informed of the tasks ahead, the pitfalls, and the ultimate goal. The desert is fatiguing, both physically and emotionally. These handicaps can be alleviated by efforts to understand the nature and importance of the ground over which Marines are to fight.

b. Acclimatization.--A period of at least two weeks is required for acclimatization. During this period the workload and exposure to the heat are increased gradually by scheduling alternate work and rest periods. After this, gradually increasing amounts of work during the hot part of the day are added.

c. Discipline.--Good discipline is vital. Commanders exercise close supervision and a high degree of leadership over their units. All training emphasizes the chain of command because the wide dispersion of units in the desert places greater responsibilities on subordinates. After arriving in the desert, commanders cannot condone any letdown in discipline.

d. Esprit de Corps.--The extreme climatic conditions of the desert and the bleak bareness of the terrain can rapidly destroy the morale of personnel not used to its hardships. Training is designed to instill aggressiveness and self-confidence. A high degree of esprit de corps is required if personnel are to overcome the adversities of the desert and not be cowed by the shock power of an enemy tank attack.

4202. WATER

All personnel participating in operations in a desert environment are made aware of the vital role played by water in such an area. Personnel are trained not to waste water and to use minimum amounts.

a. Water Requirements.--At high temperatures during the day, a man who is resting may lose as much as a pint of water per hour by sweating. If he is working, his water loss (and requirement) increases in proportion to the amount of work done. Hard-working units may require as much as 3 gallons of drinking water per man per day. Figure 27 may be used as a guide to estimate the drinking water requirements for personnel exposed to desert heat. Performing demanding labor in extremely high temperatures (110 degrees Fahrenheit or greater) may increase water requirements above these levels.

QUARTS PER MAN PER DAY FOR DRINKING PURPOSES

(A guide for planning purposes only)

Activity	Illustrative Duties	Moderate Desert Conditions (Air Temp. Below 105° F.)	Severe Desert Conditions (Air Temp. Above 105° F.)
Light	Deskwork; guard duty	6	10
Moderate	Route march on level; tank operations	7	11
Heavy	Forced marches; unloading supplies; digging in	9	13

Figure 27.--Water Requirements.

b. Use of Nondrinkable Water.--There are times when water that is not fit for drinking may be used to save drinking water. In emergencies it may be used to wet the clothing so that the body may be cooled by evaporation. In this way, the body saves the water it otherwise would have to expend through sweating. To prevent confusion between nondrinking water and drinking water, containers for drinking water are clearly marked "drinking water only."

c. Receptacles for Water.--Water for the occupants of a vehicle is carried on the vehicle in 5-gallon water cans. In the event of a leak, less water is lost than if the water is placed in larger containers. Each vehicle is equipped with a funnel, the nozzle end of which fits inside the neck of a canteen to prevent water wastage when pouring. If possible, vehicular racks are installed for water cans and ration containers. These racks should permit rapid unloading if the vehicle has to be abandoned. When such racks cannot be installed, wooden cases or frames are constructed. This prevents accidental puncturing and seam opening, particularly in water cans. Large, fixed, water tanks are unsuitable for small units. A large tank is difficult to handle, requires rigid mounting to prevent tumbling or rolling in a moving vehicle, and prohibits the cleaning of sludge or deposits from the bottom. In most cases, organic water trailers are sufficient for holding water reserves.

d. Water Discipline.--Water discipline is a part of the Marine's daily life in the desert. He is trained to conserve water and not to waste it, to drink only from approved water sources, and not to pollute such water sources as are available. When rationing is necessary, water is issued to individuals under close supervision of NCO's and commissioned officers.

4203. SALT

a. Requirements.--Sweat contains salt as well as water. This salt is as necessary for survival as the water that is lost in sweat. The ordinary diet contains enough salt to make up for that lost in sweat, when a person's water intake is less than one gallon per day. When the daily water intake is increased to 1½ gallons per day, it is possible to take in enough salt by adding extra salt to the food if a full diet is eaten. When a full diet is not eaten while troops are performing strenuous duties, salt requirements of the body may be replenished by adding salt to the drinking water or by taking salt tablets. Unacclimatized personnel take additional salt during the first few days of exposure to desert heat. Acclimatized personnel take additional salt when sweating heavily.

b. Salt Tablets.--Coated salt tablets do not cause the nausea sometimes felt after taking plain salt tablets. They are swallowed whole and are taken while drinking water or at mealtimes. When there is much sweating, two tablets are taken for every quart of water consumed.

c. Salting Water.--A convenient way to provide adequate salt to large numbers of personnel is to salt all drinking water to a concentration of 0.1 percent as depicted in figure 28.

d. Water Shortage.--When there is a shortage of water, extra salt is not taken.

4204. HEAT INJURIES

All heat injuries, except heatstroke, result from a deficiency of salt or water during heavy sweating. Heatstroke results from a failure of the sweating mechanisms. Heat injury is prevented by increasing the resistance of exposed troops and by reducing the exposure of troops to heat insofar as practicable. Every individual must be aware of the dangers of heat exposure in the desert. Subordinate commanders, with the technical assistance of medical personnel, instruct their men in the potentially serious results of heat injury and in the prevention, recognition, and treatment of heat cramps, heat exhaustion, and heatstroke.

Table Salt		Diluting Water
2 ten-grain salt tablets	-----dissolved in	canteen
1/4 teaspoonful	------------dissolved in	canteen
1 1/3 level messkit spoons	--dissolved in	5-gallon can
9 level messkit spoons (0.3 pound)	-----dissolved in	lyster bag (36 gallons)
1 level canteen cup	---------dissolved in	250 gallons (in water trailer)

Figure 28.--Preparation of 0.1 Percent Salt Solution.

a. Heat Cramps.--Heat cramps are caused by the excessive loss of salt from the body of an individual who has been sweating heavily. Cramps are painful spasms of the muscles, usually those of the legs, arms, and abdominal wall, and may be mild or severe. The body temperature is normal. Heat cramps are relieved by drinking large amounts of salt water.

b. Heat Exhaustion.--Heat exhaustion is caused by the excessive loss of water and salt from the body of an individual who has been sweating excessively. The skin is cold and wet with sweat. There may be a slight elevation of body temperature accompanied by a loss of appetite, headache, dizziness, mental confusion, and weakness. Heat exhaustion may occur suddenly or over a period of time and may strike the best acclimatized individuals when the work is heavy and the heat is severe. Mild cases are seldom fatal, but severe cases may be fatal if untreated. A stricken individual should be placed in the shade. The return of blood to his heart is assisted by elevating his feet and massaging his legs. He should be given large quantities of water to drink. Following this first-aid treatment, he should be evacuated immediately to the nearest medical installation.

c. Heatstroke.--Heatstroke or sunstroke occurs when the body loses its ability to cool itself by sweating and the skin is hot and dry. This contrasts with heat cramps and heat exhaustion where skin is cool and moist. The body temperature is 106 degrees Fahrenheit or higher. Heatstroke is particularly apt to occur in individuals who are not acclimatized to the heat and who are overweight. Heatstroke may occur within a few minutes after sweating has stopped. All personnel are instructed to watch for the absence of sweating while doing work that normally causes sweating. During the early stages after sweating has stopped and the temperature has risen, the individual may be exhilarated and unaware of the dangerous condition which is developing. He may collapse suddenly or there may be headache, dizziness, mental confusion, and even delirium before the onset of unconsciousness. Heatstroke is a true emergency and all untreated cases will die. The objective of the treatment is to lower the body temperature to a safe range as quickly as possible. The patient should be placed in the shade, his clothing removed, his body sprinkled repeatedly with cold water from head to foot, and the evaporation increased by fanning to increase the cooling effect. The arms and legs should be massaged to stimulate the circulation. Cold or cool water should be given by mouth if the patient is able to drink. As soon as possible he should be evacuated to the nearest medical installation with treatment continued on the way. Individuals who have once had heatstroke are more susceptible to further attacks.

d. Sunburn.--Severe and fatal sunburn may result from short periods of exposure to the desert sun. Persons with fair skins, ruddy complexions, and red hair are especially susceptible. Sunburn may be prevented by appropriate protective measures. Individuals who sleep outdoors during the day should sleep only in the shade and should never sleep in an isolated spot away from the unit.

4205. PREVENTIVE MEDICINE AND SANITATION

Practically every disease of known military significance may be found in the desert. Communicable diseases are prevalent among the native population. Insect-borne diseases such as malaria, sandfly fever, typhus, and plague may be found. The cold of the desert night, even in summer, may require warm clothing, and actual cold injuries may occur during the

desert winter. However, it is the desert sunshine, wind, and heat that have the greatest effect upon landing force operations. The dryness of desert heat distinguishes it from the heat of the tropics and adds to the problem of coping with it. Proper preventive medicine and sanitation measures, adequate personal hygiene, avoidance of native villages, and constant command supervision are necessary to reduce the incidence of disease and disability.

a. Eyes and Skin.--Eyes are protected from intense sunlight and wind-driven sand by tinted goggles. These may not completely protect tank drivers and others constantly exposed to the sun and the wind. Closed, tight-fitting goggles are required to prevent eye damage from dust. Blackening the area around the eyes reduces the effect of glare and improves distance vision and adaptation to night vision. The desert wind dries exposed skin surfaces and causes chapping of the lips and local skin irritation to a near disabling extreme. Cuts and scratches become infected very easily. Chapsticks and protective ointments provide some protection against these conditions.

b. Water Supply.--All water not received from approved sources is considered contaminated and unfit for drinking or bathing; it should be used for washing of clothing only in an emergency.

c. Mess Sanitation.--Intestinal diseases tend to increase among personnel living in the desert. This may be prevented by proper mess sanitation including proper cleaning of eating and cooking utensils, adequate supervision of food handlers, proper disposal of garbage and human wastes, and protection of foods and utensils from flies. Germicidal rinses are used for washing mess and kitchen gear when water is scarce or cannot be heated because of the tactical situation. Solid wastes are burned when the situation permits. Soakage pits are used to dispose of liquid wastes and are filled with soil when leaving an area.

d. Waste Disposal.--Trench type latrines are used when the soil is suitable. These should be deep because shallow latrines become exposed in areas of shifting sands.

e. Insect and Rodent Control.--Insects and rodents must be controlled if the diseases they carry are to be prevented. Preventive measures include protective clothing, clothing impregnants, insect repellents, residual and space sprays, immunizations, and suppressive drugs.

f. Personal Hygiene.--Unit commanders ensure that proper standards of personal hygiene are maintained. Foot hygiene is stressed to ensure daily washing of feet, changing of socks, and the use of foot powder by all personnel. Daily shaving and bathing is required when sufficient water is available. When sufficient water is not available, troops may clean themselves by sponge baths or by rubbing themselves with a damp or even a dry cloth.

4206. CLOTHING

Standard clothing is suitable for desert operations. Extreme daily temperature changes during all seasons require warm clothing at night and clothing that offers protection from the sun during the day. Full-length trousers and long-sleeved shirts protect the skin from wounds and infections resulting from sand and dust, insects, thorn scratches, and rock bruises.

a. Headgear.--The helmet liner is adequate headgear for desert use and is worn without the steel helmet except when under attack. The liner provides sufficient airspace for air circulation and offers adequate eye-shade and neck protection.

b. Footgear.--The standard combat boot is adequate for desert wear. Soles and heels wear out quickly in desert terrain.

c. Care of Clothing.--Because of the scarcity of water, it is difficult to maintain clothing properly. Socks can be washed in water that has been used for bathing. When water is lacking, airing and sunning the clothing helps kill bacteria.

4207. GEOGRAPHICAL ORIENTATION AND NAVIGATION

Maintaining direction and locating positions in the desert are difficult. Landing force personnel at all levels are instructed in navigational expedients and equipment prior to participating in desert operations. Extensive training is given in the use of maps, aerial photos, and other map substitutes, and in the proper use of a compass.

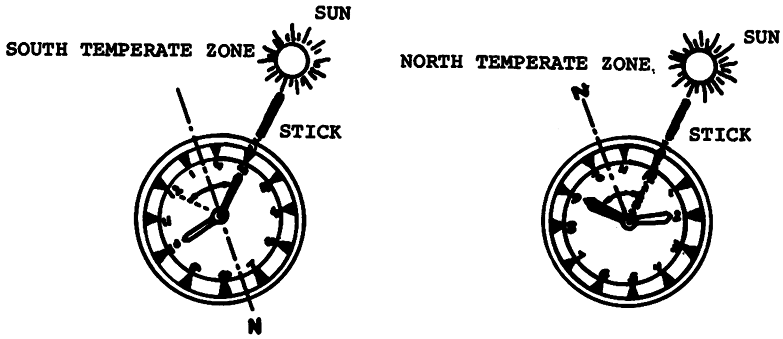
a. Knowledge of the Area.--Early in training, commanders ensure that all personnel are thoroughly briefed on the type of terrain and general environment they will encounter. Specifically, personnel receive instruction in the following: location of water sources; landmarks or any significant terrain features that may be used as landmarks such as clumps of vegetation, mountain ranges, dry streambeds, dry lakebeds, and salt marshes; the location of friendly and enemy positions; the direction of prevailing winds; and any other information that may affect the accomplishment of the mission. Such information will assist reconnaissance elements and personnel who may become separated from their units to navigate their way back to their units, to water when needed, or at least to friendly territory.

b. Determining Direction.--Direction is determined without a compass or map by use of the shadow tip method or by means of a watch. Fundamentals of these techniques are presented in figure 29.

c. Day and Night Navigation.--Navigation in the desert is similar for both day and night. When feasible, a map and compass are used to complement each other. Once a map has been oriented, the direction of travel to the destination is determined. The movable glass disc (Bezel glass) on the compass is turned until the luminous line is directly over the desired azimuth. To facilitate the march, the ground distance (map distance) is computed and recorded. Then, during the march, a pace is kept by selected individuals. The distance traveled is then recorded, based on a certain number of paces equalling 100 meters. Any attempt at navigating with a map after north has been determined by using the sun and stars is, at best, only an expedient. A compass is more accurate and much more desirable. Desert navigation is not just an extension of conventional day or night navigation. The absence of unique features and steering marks require compass and map navigational skills seldom demanded in nondesert ground navigation. Specific navigation aids of high value to commanders in desert operations include:

(1) Naval gunfire marking fires, air and ground burst.

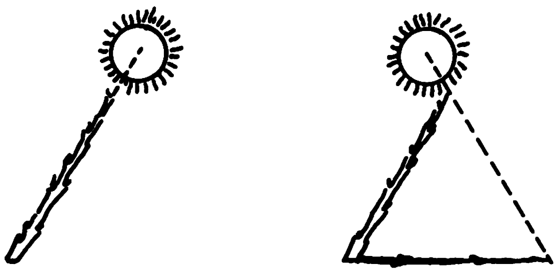
WATCH AND SUN METHOD



1. Point the hour hand at the sun by placing watch so the shadow of the stick falls along the hour hand.
2. A line from the center of the dial passing halfway between the hour hand and 12 o'clock in the smaller arc points south.

1. Point 12 o'clock at the sun by placing watch so the shadow of the stick falls along 12 o'clock.
2. A line from the center of the dial passing halfway between the hour hand and 12 o'clock in the smaller arc points north.

SHADOW TIP METHOD



NO SHADOW SHADOW POINTS EAST

1. Place a straight stick vertically into the ground at level spot where it will cast a distinct shadow.
2. Wait 10 minutes for the shadow to move. Mark the position of the shadow tip in the same way as the first. Draw a straight line through the two marks and extend this line past the stick. This is the east-west line.
3. Draw a line from the stick intersecting the east-west line at right angles. (Find the shortest straight line from the base of the stick to the east-west line.) Mark an arrow at the end of this line. The point indicates north. In the southern hemisphere (and at certain times of the year in the tropics), the arrow will point south. The first shadow tip is always the west direction; the second is always the east direction.

Figure 29.--Finding Direction by the Sun.

(2) Air bombing points.

(3) Air and ground flares.

(4) RF signal beacons, VHF and UHF directional.

(5) Smoke.

(6) Aerial balloon markers.

(7) Sextant. Sextant navigation and position determination assistance skills should be encouraged at battalion and larger units.

d. Dead Reckoning.--Dead reckoning is a system where an individual locates his position by means of a compass and calculations based on speed, time elapsed, and direction from a known point. Dead reckoning consists of recording and plotting a series of courses, each measured as to distance from a known starting point, to provide a plot from which the position at any time can be determined. In the desert, the direction traveled is determined with a compass and the distance is measured by counting paces or reading the odometer of a vehicle. Figure 30 illustrates a typical plot of a route navigated by dead reckoning over desert terrain. The starting point is point A, and the object is point B. The azimuth to point B is 75 degrees.

e. Steering Marks.--A steering mark is any well defined object in the direction of travel of a landing force unit. It is easier to follow these marks than to steer continually by compass. A steering mark may be any feature of the terrain, a cloud formation, a wind direction, or a star. A steering mark that is moving such as a cloud, a star, or the direction of the wind, is checked frequently by compass. Terrain features are checked

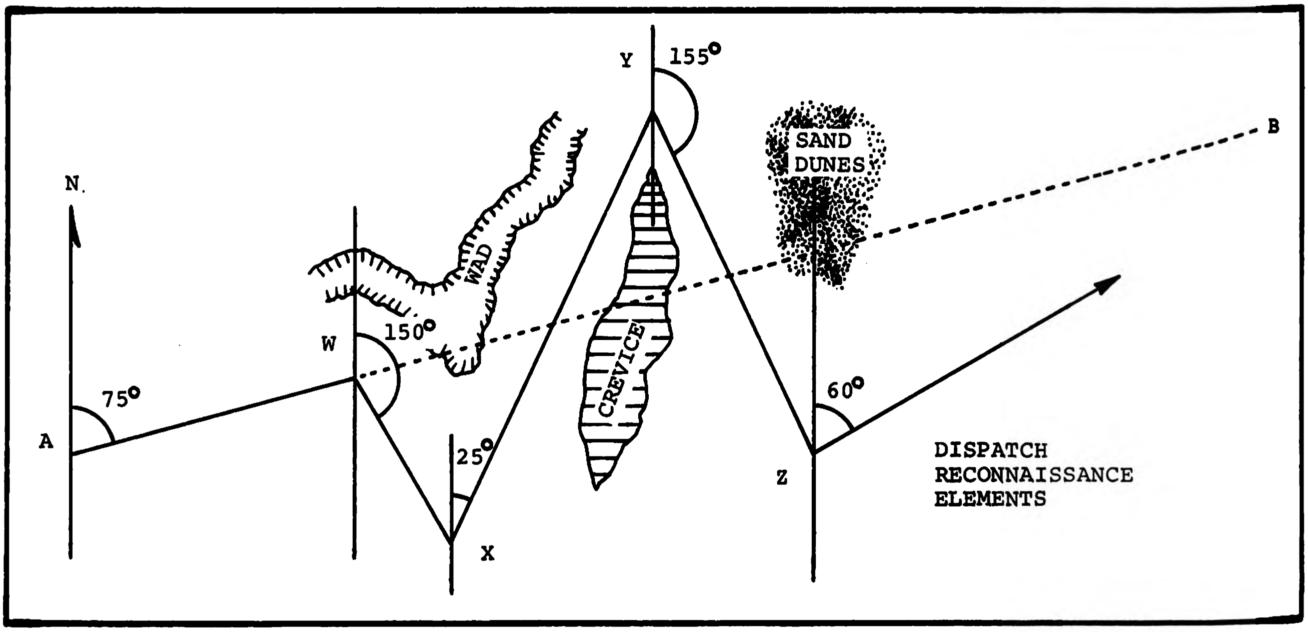


Figure 30.--Dead Reckoning Plot.

periodically to ensure that one has not shifted to another similar feature. As an aid in maintaining a straight line of travel, it is sometimes helpful to look back at the tire tracks or footprints created by the unit to see if they form a straight line.

f. Reporting of Locations.--Due to the scarcity of prominent natural or manmade features in the desert, it is difficult to report or designate specific locations without reverting to coded coordinates. A checkpoint system is normally available as a base point from which a polar coordinate system can be established.

g. Celestial Navigation.--At night, the stars may be used to find north. (See fig. 31.) North of the equator, the North Star is used to find north. The North Star does not change position, but remains practically stationary and in a northerly direction at all times. Two constellations are used to find the North Star, the Big Dipper, and the Big W. The two stars that form the side of the cup farthest from the handle of the Big Dipper are known as "pointer stars." The North Star falls on a straight line drawn through these stars away from the bottom of the cup. The distance from the North Star to the nearest pointer star is about five times the distance between the pointer stars.

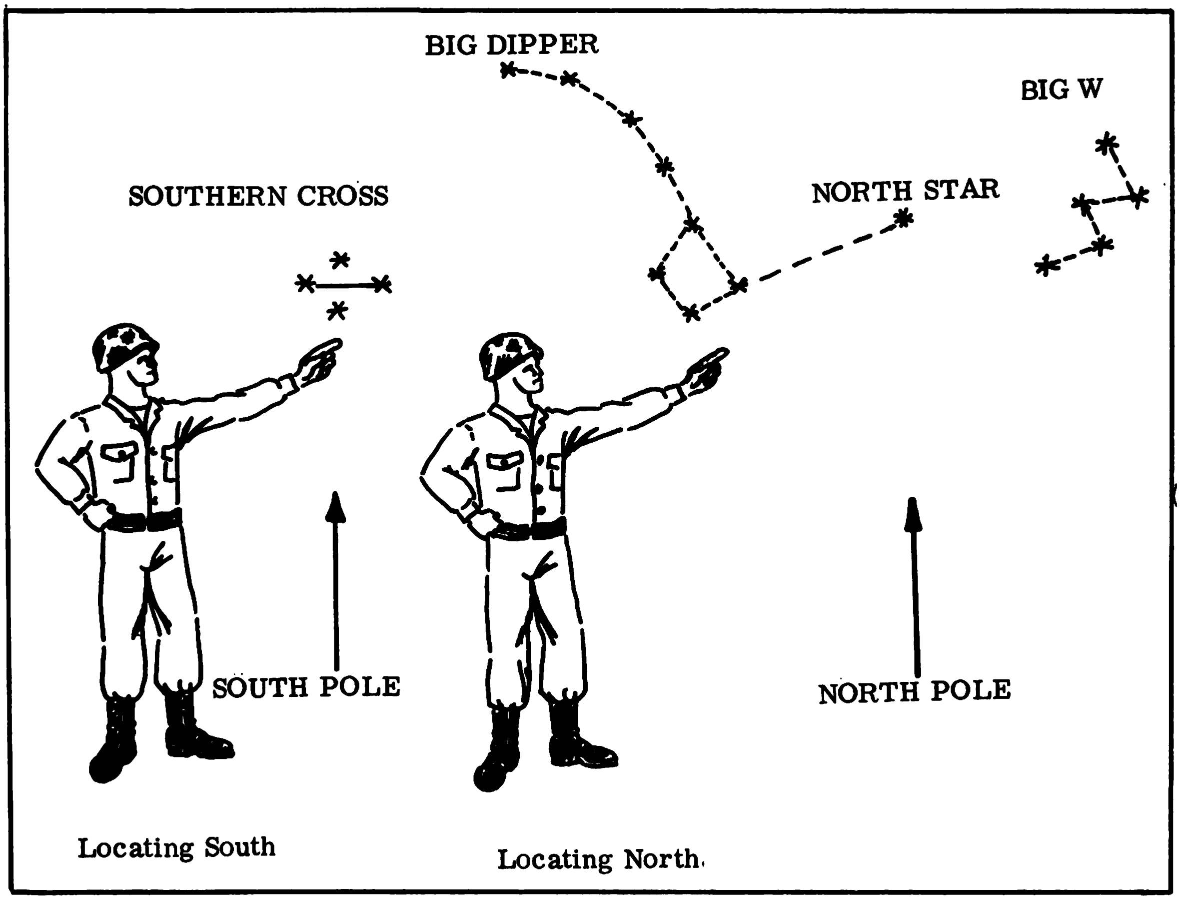


Figure 31.--Finding Direction by Stars.

(1) The Big W may also be used to find the North Star. The center star of this constellation (the star forming the center peak of the W) points at the North Star.

(2) South of the equator, there is no bright star about the south axis pole. An approximate position of south can be determined by reference to the Southern Cross. This constellation is formed by four stars. The approximate direction of south can be determined by measuring straight out from the foot of the cross a distance 4½ times the length of the cross itself. This imaginary point is the general direction of south. The two stars forming the long axis of the cross are the pointers.

4208. CAMOUFLAGE AND CONCEALMENT

Camouflage in the desert emphasizes siting, dispersion, discipline, and the skillful employment of dummies and decoys to achieve deception or surprise. Total concealment is rarely achieved, but proper camouflage measures can reduce the effectiveness of enemy observation and operations.

a. Siting.--Positions in the desert are sited to fit or blend into the existing ground patern with a minimum amount of change to the original terrain. On the desert, it is generally necessary to hide "on the pattern" rather than under or behind it, because of the low cover. All vehicles are parked with their rear towards the sun. Best results are obtained by having shadows fall on low vegetation or rough ground.

b. Camouflage.--Camouflage is used more extensively in desert areas than in normal terrain and greater emphasis is placed upon artificial camouflage means. Concealment by camouflage is difficult to achieve. Movement in daytime is generally restricted because of the lack of concealment and cover from air attack; unavoidable dust clouds betray any movement.

(1) All vehicles and weapons are equipped with camouflage nets. Maximum use is made of shadows in broken ground, wadis, and dune areas as well as the shadows cast by vehicles and weapons to hide equipment. (See fig. 32.) However, improperly used shadows reveal the location and nature of the objects being hidden. Vehicles and weapons are dug in to conceal, distort, and reduce their shadows.

(2) Camouflage of helicopters is difficult because of their unique geometric design and the highly reflectant surfaces of their machined parts and skin.

c. Dispersion.--Lack of concealment increases the need for dispersion. Individuals and elements of the landing force disperse to the maximum extent consistent with the need for security and mutual support. The greater the mobility of the landing force, the greater the dispersion it can accept, provided adequate means of communication are available. Dispersion of battalion-size elements of the landing force reduces their vulnerability to enemy air or nuclear attacks. Generally, parked vehicles are separated by at least 150 meters during daylight. This interval may be reduced at night, depending upon the amount of moonlight and the capability of enemy aircraft to observe the installations and activities of the landing force.

d. Digging.--The best solution to eliminate cast shadows in the desert is to dig in. When terrain permits, digging in is a must for units

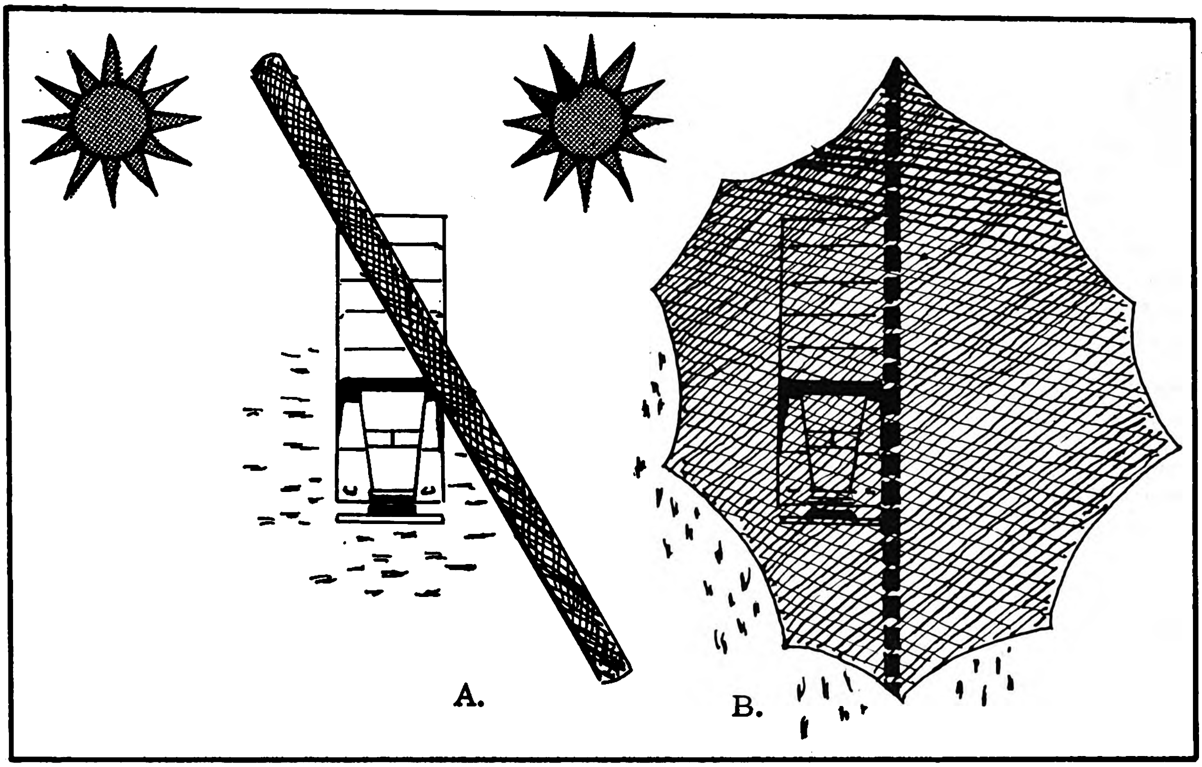


Figure 32.--Concealing a Vehicle With a Drape Net.

of the landing force that are halted for more than a few minutes. This helps prevent the loss of men and material in the case of nuclear or surprise air and artillery attack. Suitable ground for digging in is an important consideration in selecting assembly areas. Upon arrival in the assembly area, trenches are sited near brush along sides of rock, on rough ground, or in the shadow of existing objects. They are covered with shelter halves, or salvage materials such as old sandbags. When amphibious assault elements remain in an area for a number of days, vehicles are dug in.

e. Vehicles.--The need for concealment of vehicles is not confined to personnel safety alone, nor is it for the preservation of an individual vehicle. If the enemy spots one vehicle, he will systematically search the area for others and gain information as to the movement and intent of the landing force.

(1) In bare desert, and in places where vegetation is extremely sparse, tracks left by a wheeled vehicle are so faint that they are hardly noticeable to the unaided eye beyond 450 meters. Where the surface consists of pebbles veined with bare, light colored sand, vehicle tracks can be picked out where they cross the pebble patches. Generally, as long as

vehicle tracks are kept dispersed, they are inconspicuous to the unaided eye, provided a number of vehicles do not follow the same tracks.

(2) Vehicles on a patternless background are conspicuous in tone and shadow, while vehicles in or near a patterned background are much less noticeable.

(3) Vehicle drivers are trained to understand and apply the simple rules of concealment. Where vegetation is higher than vehicles, vehicles are placed completely under it. Where a single tree or a clump of trees does not provide sufficient concealment, the vehicle is parked adjacent to it so that the shadow is distorted by the shadow of the tree. With smaller plants, the rear of the vehicle is faced toward the sun with the front end of the vehicle touching the plant. The shadow is minimized by the cab and the hood, and then further distorted by the plant. In areas where there are low shrubs, the vehicle is sited among them so that the vehicle shadow is interrupted. On broken ground, advantage is taken of larger rocks to distort vehicle shadow. Washes and other depressions are excellent locations for vehicles because the banks absorb the shadows. However, such features become riverbeds during sudden rainstorms.

(4) Metal surfaces on vehicles are treated to keep light reflection to a minimum. Camouflage paint or mud is used for all vehicles and equipment. When this is not available, application of an adhesive such as grease or oil, plus the addition of sand or dust, may be used.

(5) Disabled vehicles are vulnerable targets. If repairable, every effort is made to conceal them. When practicable, they are moved to a site offering cover and concealment. This also provides maintenance vehicles and their crews some protection while working on disabled vehicles. When a disabled vehicle cannot be moved, it may be camouflaged by other means, such as the skillful use of nets.

(6) Numerous converging vehicle tracks reveal the location of landing force installations and command posts. To avoid this, vehicles follow designated routes when they approach such areas. Troops are discharged 300 to 400 meters from the installation and walk. To aid in deception, main routes and trails continue through the installation. The vehicles proceed to a dispersal area or vehicle park. Paths from the dispersal area to the installation follow a devious irregular course through as much cover as possible. In addition to vehicle discipline, maintenance of strict night light discipline is essential at command posts and other installations.

(7) Vehicles that make abrupt turns to avoid minefields sometimes reveal the locations of these fields. Properly controlled, these tracks can deceive the enemy and help maintain the security of minefields.

(8) When time and conditions permit, vehicles are dug in and further concealed by the use of nets and/or natural materials. In any attempt to conceal a vehicle, the strong contrast of internal shadows cast within the wheel wells and the undercarriage must not be forgotten. These shadows may attract attention when nothing else does.

f. Nets.--A camouflage net that relies, as is normal, on concealment by casting irregular shadows to break up the form of the concealed object is

useless in barren deserts. To be most effective in this environment, a camouflage net must be a complete cover which relies on imitation of its ground surface in color and texture.

(1) The standard method of garnishing, with a normal percentage of voids, produces too dark an effect even though the garnish is a perfect match in color. To remedy this, nets are garnished solid, without voids, with the garnish threaded in long straight strips. This helps give the necessary lightness of texture and tone. There are large areas of the desert where such a net photographs too dark because the fabric texture of the garnish strips deepens the tone. In these areas, a more reflective or smooth material is used.

(2) Drape nets and drape net sets are the most practicable for use in desert terrain. The flattop nets, with the garnish thinned out toward the outer edges, cast conspicuous shadows on the ground.

Section III. TACTICS AND TECHNIQUES

4301. GENERAL

An amphibious task force executing an amphibious assault in the coastal approaches to a desert require naval supremacy against enemy surface and submarine forces, preponderant air superiority to the degree required to neutralize enemy mechanized activity in the objective area, and a substantial superiority over enemy forces ashore in the objective area. The development of amphibious plans for such operations parallels standard procedures for amphibious planning delineated in LFM 01, Doctrine for Amphibious Operations, and LFM 02, Doctrine for Landing Forces. The following planning considerations require special attention:

a. Determination of Landing Beach.--Two major factors affect the selection of the landing beach: the capacity of the beach for landing supplies and equipment; and the suitability for beaching landing ships, landing craft, and amphibious vehicles. The increased requirement for mobility once ashore and the correspondent increase in logistic support incidental to such operations generate requirements for increased shipping. The landing beach and terrain in back of the beach must provide sufficient trafficable area to facilitate the rapid development of the landing force's combat power ashore.

b. Selection of the Tentative Date and Hour of Landing

(1) Large scale operations are timed for winter, when practicable. The high daytime temperatures of summer greatly affect troops and equipment and reduce their effectiveness.

(2) Consideration is given to the feasibility of a night landing. When this is precluded, the landing is scheduled for first light so that initial objectives are reached prior to midday, or for late afternoon so that the attack may continue during the cooler part of day and during the night. When possible, the landing is made with the sun at the back of the landing force.

c. Objective.--While the objective in a desert operation is the enemy rather than particular terrain features, the initial scheme of maneuver ashore and the designation of a force beachhead (FBH) are normally tied to terrain features. The similarity of desert terrain and the lack of readily identifiable terrain features makes the marking of boundaries and phase lines particularly difficult. In many cases, landing force elements will have to be assigned an axis of advance on a specified azimuth. In addition, smoke, tracer, and/or pyrotechnic fires may be employed to assist assault elements in maintaining direction. The unlimited range of observation and the lack of concealment and camouflage necessitate the employment of a larger beachhead than in normal operations to provide dispersion and to ensure that installations and facilities of the landing force are screened from enemy observation and fire.

d. Vertical Envelopment.--A significant vertical envelopment capability is highly desirable in the desert environment. Properly employed, a vertical envelopment permits optimum utilization of the landing force in the seizure of objectives with a minimum expenditure of time and casualties.

Such an operation takes the form of a two-pronged amphibious assault. This consists of a vertical envelopment by helicopterborne forces who effect an early linkup with waterborne forces consisting primarily of infantry, tracked and wheeled vehicles, artillery, and logistic support units. Helicopters may also be employed in limited operations in the desert such as amphibious raids and subsidiary operations.

e. Maneuver.--The scheme of maneuver for the landing force ashore is designed for the large-scale landing of helicopterborne troops to seize designated objectives within a minimum of time following the preparation fires. Once these objectives are seized and linkup effected, plans provide for further active offensive measures. The action to secure the beachhead and to extend the area dominated by the force landing in the area is characterized by a rapidity of events to afford the enemy a minimum reaction time.

f. Supporting Arms

(1) Preparation Fires.--Preparation fires are delivered on the objective in the greatest possible concentration in order to increase the shock effect. These preparation fires are accompanied by other fires and airstrikes to isolate the objective and deny enemy air and mechanized forces the capability of interference with the landing of helicopterborne forces or movement of mechanized forces.

(2) Fire Support.--Initially, fire support relies primarily upon air support and naval gunfire. Supporting aircraft and helicopter-transported artillery, rocket, and mortar-type weapons are used in support of action adjacent to the initial landing zone. The organic antimechanized capability of any helicopterborne enveloping force employed is increased as appropriate by attachment of additional recoilless rifles, rocket launchers, light antitank assault weapons (LAAW's), or any other helicopter-transportable antitank weapon that may be available.

(3) Antimechanized Weapons.--Particular emphasis is placed on the role of supporting arms in the antimechanized defense plan. Extensive employment of armor in the desert and the vulnerability of the landing force to mechanized counterattack aggravate this problem. Since natural obstacles are lacking, heavy antimechanized weapons are landed early in the assault. These weapons need obstacle-free approaches to the beach and suitable routes of egress from the beach.

(4) Air Superiority.--With little cover and concealment available, all installations are vulnerable to attacks from the air. Therefore, the mission of gaining and maintaining air superiority in the objective area is a continuing consideration. It may necessitate the early displacement of the landing force's antiair warfare capability ashore.

g. Logistic Support.--Initial logistic support of the assault forces may have to be effected by helicopter or by airdrop from land or sea-based aircraft. Internal distribution within assault elements, possibly to battalions, may likewise be effected by helicopter with further distribution by light vehicles and trailers. Casualty evacuation will initially be effected by helicopters, pending establishment of adequate medical facilities in the landing area.

4302. OFFENSIVE ACTIONS ASHORE

Once the landing force has projected its combat power ashore, future offensive operations are conducted in accordance with the tactical principals delineated in FMFM 6-1, Marine Division; FMFM 6-2, Marine Infantry Regiment; and FMFM 6-3, Marine Infantry Battalion. Such principles are modified to the degree necessary to cope with extremes of the desert environment.

a. Movement to Contact.--Movement of the landing force inland is based on moves forward by a series of bounds, each of which is made secure tactically and logistically before the next is occupied. The main points in the selection of the successive areas to be made secure are: water supply; communications by land, sea, and air sufficient to ensure the maintenance of the landing force; and defensibility of a series of firm bases from both the tactical and logistic viewpoints.

(1) While the main body of the landing force moves forward methodically and surely, mechanized-motorized and helicopterborne forces advance to gain contact with the enemy and seize successive objectives.

(2) The rate of advance inland during this phase of the amphibious operation depends on the air situation. Given air superiority, the advance is speedier and more secure. Information concerning enemy forces can be collected, and at the same time, the enemy's capability for air warfare is restricted. Further, the problem of supply can be made easier inasmuch as supplies can be displaced ashore with minimal interference from hostile aircraft.

b. Types of Attack.--In the desert, minefields and the layout of antitank guns are normally the main features of hostile defensive positions. The extent of the minefields and the number of antitank guns, in large measure, determines the type of attack which is feasible. A quick combined infantry and tank attack supported by aircraft, naval gunfire, and artillery is employed when the enemy has had little chance to develop minefields. Against well developed minefields and organized antitank positions, a breaching operation is necessary, either after a bridgehead has been established through the minefield by the infantry, or as a part of the consolidated attack. Where there are open flanks, mechanized formations and/or helicopterborne elements of the landing force move around these obstacles to execute attacks on the enemy's lines of communication, headquarters, and reserve formations in coordination with the attack on his main defenses. To overcome the vulnerability of tanks to antitank guns, and the infantry to small arms fire in the nakedness of the desert, night attacks are given careful consideration. On other occasions when tanks are available in sufficient numbers, breaching operations in daylight are possible. When planning a daylight operation, the position of the sun is often a deciding factor as to timing.

c. Preparation for the Attack

(1) Planning.--The main point in planning the attack is to ensure that the enemy is actively mislead or kept in doubt as to the landing force's intentions. This needs careful planning and control at the landing force level with regard to:

(a) Air, naval gunfire, artillery, and patrol activity.

(b) Allotment of concentration areas far enough to the rear to avoid disclosing the area selected for the attack.

(c) The location of assembly areas and attack positions, and the timing of moves to these positions.

(d) The enemy can receive major intelligence input by the substantial increase in radio traffic which normally precedes operations. Further, he can receive intelligence from carelessness or poor transmission discipline.

(2) Support/Service.--Support units bringing forward ammunition and supplies for the attack normally move at night. Excessive dumping in the desert is more dangerous than in other areas where there are sites and roads easily located on the map. Once a dump is left behind in such a wide open space, it is often lost forever. While traffic control is made more difficult by the lack of natural routes, routes can easily be laid out. These can be either axes which are laid out straight cross-country on a compass bearing, or reconnoitered tracks following the best "going" available. In either case, they are clearly marked so that they may be seen at night.

d. The Attack.--In the desert, an attack is normally a combined tank and infantry attack. The quick attack by day in areas clear of mines is common in the early stages of the battle and later in the pursuit of withdrawing enemy forces. This form of attack requires proper planning and coordination, even when conditions are favorable from every point of view. The method varies according to the situation and the strength and depth of the enemy defenses. Normally, attack plans are based upon the following factors:

(1) The proportion of tanks and antitank weapons to assault infantry elements is as generous as possible.

(2) All assault elements are mobile insofar as practicable and feasible; i.e., mechanized, motorized, or helicopterborne.

(3) The average frontage for one battalion is greater than in normal operations.

(4) The assault element consists of tanks and assault infantry elements.

(5) The followup echelon consists of infantry closely followed by tanks ready to give immediate support to the infantry.

(6) The strongest possible artillery and close air support are coordinated with the attack of the assault echelon. The screening of the flanks by fire or by smoke is an integral part of this support.

(7) Upon the arrival of the infantry on the objective, tanks of the assault and followup echelons assemble in an area behind the forward infantry positions and prepare to continue the attack.

(8) A reserve of tanks and infantry is held ready for immediate action in any direction.

(9) Tanks remain in forward assembly areas until infantry unit antitank weapons have been positioned and properly dug in.

(10) When this stage of reorganization is reached, tanks are normally withdrawn to rear assembly areas. Such areas are covered from enemy observation and in a position where the crews can refuel their tanks, perform required organizational maintenance, and rest.

e. Night Attacks.--Night attacks by tanks and infantry are desirable when the strength of landing force artillery relative to the artillery strength of the enemy is not very great and/or the enemy is strong in tanks and antitank guns. Frontages and depths are reduced at night to half the frontages by day, though this may be increased when the attack is made by moonlight. Best conditions for the night attack are about half-moon with the moon behind the assaulting landing force elements but not so low that the tanks are silhouetted against it. Other points of importance are:

(1) Close coordination between tanks and infantry is even more important at night. The attack is made at infantry speed with infantry guiding. The tanks follow closely in support of the infantry. Infantry and tank elements require prolonged integrated training periods under conditions of reduced visibility so that assault troops are aware of, and can cope with, the dangers inherent in operating in close proximity to tanks at night.

(2) Tanks and infantry generally attack on the same axis, with tanks under infantry command.

(3) The plan is simple and is based on detailed reconnaissance. Where feasible, an integrated rehearsal is conducted.

(4) Light signals such as pinpoint lights of different colors are arranged between tanks and infantry.

f. Breaching Minefields.--Where minefields have to be crossed and mines lifted before tanks can be launched for exploitation, infantry elements of the landing force attack to seize and establish a bridgehead. Such units require extensive engineer support when the enemy employs antipersonnel mines and well developed obstacles in his defense. As soon as sufficient progress has been made by the attack, minefield lanes are cleared and marked. Tanks, antitank guns, close support weapons, and supplies and ammunition are moved through these lanes so that assault elements of the landing force can be ready to withstand counterattacks by enemy tanks and infantry.

(1) The cover of darkness is necessary for these operations so that reorganization can be completed before dawn. The attack takes place early at night or late in the afternoon. The advantage of the evening attack is that the whole night can be used for mine clearance and the movement of supporting tanks and weapons to the objective. The forming up of assault elements of the landing force and the initial move forward from the line of departure is also simplified during daylight. Moonlight assists this sort of operation, but it should not be so bright as to facilitate the enemy's counterattack.

(2) The chief disadvantage of this type of attack is that the main burden falls on the infantry elements since they cannot be followed up

by their normal supporting weapons until mines are cleared. Unless they arrive on their objectives with a reasonable fighting strength and anti-mechanized capability, they cannot hold the positions won. The most effective way of avoiding casualties is for the infantry assault elements to move immediately behind its supporting artillery fires, even at the risk of sustaining a few casualties from its own artillery.

g. Fire Support Coordination.--Normal procedures for fire support coordination delineated in FMFM 7-1, Fire Support Coordination, are applicable in the desert environment. The following special points of detail apply:

(1) Assistance in controlling the timing and direction of the attack and fixing positions is required because features on the ground which may be used for this purpose are virtually nonexistent. Such assistance may be provided by:

(a) Surveying the line of departure on the artillery grid exactly at right angles to the axis of the attack.

(b) Marking the line of departure by artillery fire for sufficient time to enable the assault elements to close upon it.

(c) Using rounds of smoke to indicate boundaries and phase lines which generally coincide with pauses or lifts in supporting fires.

(d) Employing smoke to mark division and regimental boundaries.

(e) Firing tracers along the flanks or along the axis of advance.

(f) Marking the objective with smoke.

(g) Fixing the position of forward troops by flash spotting methods used to observe flares or rockets fired, especially for the purpose, by the forward troops on the ground.

(2) Because overhead protection is difficult to construct, the use of VT fuzes is effective and causes casualties to the enemy even when he is otherwise well dug in.

(3) Heavy concentrations of artillery fire against enemy armor or other vehicles forming for an attack will impede the former and often defeat the latter before the attack is launched.

h. Exploitation.--This is normally the task of reserve elements of assault units. Where mines are few or nonexistent, the bold use of vehicles and tanks in daylight accelerates exploitation and helps to reduce casualties.

(1) An open flank constitutes a danger spot as it is the likely area for enemy counterattack. Protection is carefully provided in the form of mines covered by automatic weapons and antitank guns. Tank and antitank units in reserve and not earmarked for the assault are suitably positioned to counter enemy action against open flanks.

(2) Success in this stage of the battle depends upon the successful reorganization of the objective. Each objective serves as a firm base for further attack. Further, the enemy's power of resistance may be broken by the failure of his counterattacks and the losses incurred in making them. The main difficulty in reorganizing in the desert is the digging in of antitank guns and automatic weapons in time. The ground is very hard and the early arrival of power equipment and demolitions at the objective is extremely important. Priority is given to antitank gun positions. The use of mines to protect infantry during reorganization provides moral as well as material support. However, careful planning and coordination is required when exploitation by tanks and/or mechanized forces is to be made in the same area.

i. Pursuit.--Pursuit in the desert is carried out by helicopterborne and mechanized elements with the greatest possible energy and speed. The immediate objective is to cut off the defeated enemy from his bases of supply and reinforcing units and then destroy him. It is not easy to intercept withdrawing enemy forces in the desert, particularly when they have a mechanized capability. The retreating forces can disengage and move back rapidly by successive bounds where they can reorganize and resupply. In the early stages of the pursuit, it is most important to disorganize the enemy by immediate attacks on his headquarters, logistic areas, and artillery positions. Later, the pursuit aims at deep and decisive interception during which great distances will have to be covered. In such circumstances, the pursuit is best organized as a helicopterborne and mechanized task force with close air support cover and aerial resupply. Logistic difficulties are the main problems in maintaining the speed and impetus of such a force. While aerial resupply can resolve these problems to a degree, detailed preliminary planning and organization are required.

4303. DEFENSIVE ACTIONS BY THE LANDING FORCES

There are a number of vital areas in desert countries, such as ports and good water supply areas. Except for such areas, the retention of a hundred miles or so of desert terrain normally makes little difference. Accordingly, defensive actions conducted by the landing force are based less on terrain considerations than on the selection of the most suitable general area in which preparations for resuming offensive operations, including the buildup of logistic resources, can be effected. Sufficient depth in front of this selected area is ensured by defensive positions. Normally, the defensive aspects of desert operations result in establishing a series of firm bases which act as pivots and supply areas for mobile offensive action. Only very rarely can positions be found where both flanks of the landing force rest on secure obstacles.

a. Types of Defense.--Defense in the desert is characterized by a depth of mutually supporting positions. Further, the requisite mobility to disengage and withdraw in the face of an overwhelming, fast-moving attack is maintained in order to regroup and seek a decision under more favorable conditions, rather than suffer complete defeat in place. Landing force units may employ either a mobile or area type defense.

(1) Mobile Defense.--A mobile defense is well suited to the desert environment except in mountainous areas. The mobile defense employed is conventional, consisting of:

(a) Security elements, including helicopterborne forces operating at maximum practical ranges.

(b) A forward defensive area comprised of any combination, dependent on the terrain, of islands of resistance, strongpoints, and observation points.

(c) A reserve force which may include helicopterborne forces, whose mission is to destroy the enemy force at a time and place of the defender's choosing.

(2) Area Defense.--An area defense consisting of security elements, holding garrison, and a reserve is employed when:

(a) The mission requires holding particular terrain.

(b) The terrain restricts the enemy's capability for maneuver and/or affords natural lines of resistance.

b. Selection of Ground.--Careful air and ground reconnaissance is required to select those positions best sited to facilitate defensive action by landing force units and at the same time make the enemy's attack more difficult. Special attention is given to any area which affords good observation, which takes advantage of cover and concealment afforded by scrub or broken escarpments and depressions, which contains obstacles such as large patches of soft sand that will impede enemy movement, and whose interior is accessible to mechanized elements of a landing force.

c. Covering Force.--A mobile covering force operating well ahead of the forward edge of the battle area (FEBA) is normally necessary. Such a force is task organized from elements of the landing force and is provided the organic fire support it requires to carry out its assigned mission. The covering force operates under a single commander. Duties of the covering force include:

(1) Maintaining contact with the enemy and observing his activities and movements.

(2) Probing behind the enemy's screen to harass his communication, command, and logistic establishments.

(3) Giving early warning and information as to the direction, strength, and speed of advancing enemy units.

(4) Delaying the enemy's advance while effecting a coordinated withdrawal. Such a withdrawal is normally executed in a series of bounds and is carefully planned in conjunction with the commander of the landing force element holding the FEBA.

d. Organization of the Defense.--The organization of the defense in the desert is in accordance with the general principles contained in FMFM 6-1, Marine Division; FMFM 6-2, Marine Infantry Regiment; and FMFM 9-1, Tank Employment/Antimechanized Operations.

(1) Antimechanized.--The coordinated siting and employment of all available antimechanized resources available for the defeat of enemy tanks receives first priority. Antitank guns are well dug in, concealed, and defiladed as much as possible from direct observation and fire. Minefields assume an even greater importance in desert country than elsewhere,

because they afford practically the only form of obstacle in such country. There is scope for much cunning and deception in the planning of minefields in desert country, particularly in the employment of phony minefields.

(2) Artillery.--Artillery positions are sited where they are protected by infantry elements of the landing force from tank attack. When weapons cannot be so sited, they are positioned to have a clear all-round field of fire, so that they can engage tanks in the open by direct fire at suitable ranges.

(3) Tanks.--All tank units have carefully selected and well dug-in battle positions, regardless of their anticipated employment. Positions are most effectively located on ground which is likely to force the enemy to attack. Tank units in well prepared and sited positions can inflict decisive casualties on the enemy's attacking tanks. However, care is taken not to use tanks solely as mere antitank guns.

e. Construction of Positions.--In the desert, positions are not easily dug in. Either rock is met close to the surface or the sand is so soft and shifting that normal digging is slow and/or unsatisfactory. In soft sand, there is a requirement for large numbers of sandbags and concrete. In rock, the provision of special digging equipment such as pneumatic drills, shaped charges, and demolitions is frequently necessary. Both these requirements are considered by landing force planners in developing plans for the amphibious operation. The construction of defensive positions is further complicated by difficulties of concealment. Narrow slit-type trenches, flush with the ground and with appropriate camouflage cover, give the best hope of concealment. Overhead cover is conspicuous and often may have to be sacrificed to ensure concealment. The conflicting requirements for protection against airburst shells and for concealment are weighed when deciding on the specific types of defenses to be constructed.

f. Logistics.--Sufficient quantities of food and water are held in well-forward positions to permit the intensive period of the battle to be fought out without the necessity for resupply. Since a shortage of ammunition can lead to disaster, a detailed consideration of the situation is required to forecast the correct amount of ammunition to be placed in defensive positions. Oversupply, based on careful calculation and not merely on guesswork, is preferable to a shortage of ammunition in battle. Maintenance areas and supply and ammunition dumps are sited sufficiently in the rear of the battle area to ensure that they are not overrun in the wide and deep enveloping maneuvers which must be anticipated. For the same reason, motor transport vehicles and maintenance equipment are also located well to the rear. All vehicles within shelling range of the enemy, or likely to be brought under attack by aircraft, are dug in so that engines and tires are protected from shell or bomb splinters.

g. Conduct of the Defense.--The enemy assault in the desert is normally carried out from long range by mechanized and mobile/helicopter-borne forces, directed against the flanks and rear of the landing force positions. Such attacks dispense with many of the normal preliminaries of the preparatory phase. The ability of the landing force to cope with an attack depends, to a large degree, on the effectiveness of its long-range aerial reconnaissance, the watchfulness and alertness of its covering force, and the reaction time provided through its antimechanized warning system.

Normally, the antimechanized actions conducted by elements of the ATF decide the issue. The landing force's antimechanized plans provide for engaging the enemy's advancing tank elements as far forward of the FEBA as possible with all available antimechanized resources. Once enemy tank activity is detected, all available attack aircraft, naval gunfire ships, and artillery are directed against tank targets. Antitank weapons of the landing force engage the enemy's advancing tanks with massed fires as soon as they come within effective range. Tanks, held in reserve while the enemy's attack is developing, maneuver to gain positions from which they can strike the enemy from its rear or flanks and deliver a decisive blow against his tank elements. In such situations, the landing force's antimechanized plan must be thoroughly understood by all participating elements of the amphibious task force if they are to provide for the earliest possible destruction of the enemy's tanks and permit the landing force to regain the initiative and resume its amphibious assault role. In this respect, the antimechanized plan for the landing force anticipates stopping the enemy tank force and provides for counterattack measures. The tempo of operations in a mobile environment is such that counterattack measures require precise timing at all levels. Reorganization in the desert is not easy. The well planned and immediate counterattack has every chance of success when it can be covered by all available fire support.

h. Withdrawal.--When withdrawal in the desert is inevitable, landing force units have little to gain by attempting to engage in a running fight. It is better to disengage and get back to the next good defensive position where an effective defensive operation can be executed and the initiative regained. The distance to withdraw is based on sound tactical considerations and is not affected by false sentiment with regard to the loss of ground which, in effect, is of little value.

(1) Withdrawing elements normally consist of elements of at least battalion size. Otherwise, it is almost impossible to present organized resistance to an enemy force which may attack through an open flank while the withdrawal is in progress.

(2) Sufficient means of transportation are provided to all withdrawing landing force elements. No unit can be expected to withdraw any distance on foot. The operation is essentially motorized/helicopterborne.

(3) Withdrawal plans anticipate landing force elements being cut off and/or totally surrounded. Withdrawal of such units at night is often feasible, provided a simple clear plan is employed.

(4) All personnel are indoctrinated as to the ease of escape and evasion in conditions of highly mobile warfare. Careful guarding and evacuation of prisoners is not normally feasible in the desert. A large proportion of captured personnel have a good chance to escape if they are determined to do so and are alert to the opportunity when it presents itself.

(5) Contact with the enemy is retained throughout the withdrawal by means of attack and reconnaissance aircraft and by the covering force. Temporary delay is imposed at intermediate positions whenever practicable and feasible. Subject to the requirements of the battle for air superiority and the need for aerial reconnaissance, air operations can most effectively impose delay on the enemy and raise the morale of landing force elements. Air operations are directed first at the enemy's tanks and

then against the enemy's supply organization. Logistic difficulties often provide a very effective brake on the rapid advance of hostile mechanized forces.

(6) As the withdrawal progresses, it is essential to destroy all useful supplies that cannot be brought out by landing force elements to ensure that the enemy's logistic problems are not eased. Gasoline and water are the most important commodities to be denied to the enemy. All inoperative vehicles, tanks, and guns, including those captured from the enemy, are set on fire or blown up. The importance of this matter is impressed on all personnel. All landing force vehicles carry incendiary grenades for this purpose in case the need arises. Though it is difficult to deny the use of airfields for any considerable period, airfields are mined and boobytrapped as thoroughly as possible. Since water supplies are vital to the enemy, their destruction is effected. Wells may be permanently fouled by the use of oils.

4304. EMPLOYMENT OF INFANTRY ELEMENTS

In the attack, the role of infantry elements of the landing force is predicated upon the degree of mobility they possess relative to that of the enemy. Elements operating on foot and restricted to organic transportation means may be employed in the assault landing but lack the maneuver capability to exploit the initial landing and move rapidly inland over bare, open desert terrain against an enemy with a mechanized capability. To be employed effectively in such an environment, infantry elements of the landing force require increased mobility; i.e., helicopters, trucks, LVT's, etc. In addition, these operations are supported by tanks, aircraft, artillery, and naval gunfire.

a. Infantry elements are used to establish bridgeheads through antitank minefields, tank traps, and other obstacles to landing force operations, and to follow closely the attack of mechanized elements in order to hold the ground gained, to mop up remaining hostile forces, and to exploit the success achieved.

b. Infantry elements may be required to protect or escort supply convoys.

c. In combination with other forces, infantry elements in pursuit are employed to block routes of retreat at defiles, or other critical areas, while armored elements complete the destruction of the trapped enemy.

d. Motorized infantry units, heavily reinforced with artillery and tanks, are particularly adapted to defensive and delaying actions.

e. Because of the lack of cover and concealment and the good observation found in desert operations, infantry will often achieve greater success by use of night attacks.

4305. EMPLOYMENT OF LANDMINES

Landmines are employed in desert areas in much the same manner as in other operations. The wide expanses of desert terrain make their installation expensive in terms of manpower, transportation, and equipment. They are normally required to provide for close-in antimechanized protection of the landing force. Landmines are used in the desert to slow and

canalize the enemy's mechanized forces in those areas which afford trafficability to such forces. Extensive use of mines is paramount when the landing force is compelled to assume the defense. Landmines reinforce defensive positions, provide depth, and assist in slowing or stopping the enemy long enough to permit landing force elements to mount a crushing counterattack. Special desert characteristics considered in laying minefields include:

a. Expanses, distances, and lack of well defined routes of movement.

b. Lack of natural concealment.

c. Shifting sand in some areas.

d. Lack of natural obstacles.

e. Effect of blowing sand.

f. Logistic problems inherent in the movement and storage of large numbers of mines required to lay an effective barrier.

g. Ease with which the enemy can detect mine laying or clearing teams.

h. Ease with which the enemy can bypass mined areas.

4306. EMPLOYMENT OF HELICOPTERS

The employment of helicopters in the desert is compatible with procedures delineated in FMFM 3-3, Helicopterborne Operations. The helicopters supporting a landing force are one of the better means of providing required mobility to infantry elements. The excellent flying weather prevalent in desert areas enhances their extensive use. However, the desert environment imposes a number of restrictions upon their employment. Principal among these are:

a. Daytime Temperatures.--The high daytime temperatures severely restrict the lift capability of helicopters. This may be overcome by conducting major helicopter operations during the cooler periods of the day and restricting daytime operations to patrol activity and small raids.

b. Sand and Dust.--Blowing sand and dust pit windshields, damage rotor blades, and increase maintenance problems. There is little United States data available on the subject, but French helicopter units in Algeria experienced a need for engine change at 300 to 350 hours instead of the normal 600 hours. Means for reducing wear and resultant maintenance requirements include:

(1) The careful selection of areas for maintenance, refueling, and takeoff so as to minimize the amount of dust and sand that is disturbed by the rotary wings or by normal winds.

(2) The use of covers on all moving parts when not in use.

(3) The use of oil or soil-congealing agents on takeoff areas. Consideration is given to the effects of such agents on organizational camouflage and concealment.

(4) The use of running takeoffs and landings to reduce the updraft of sand caused by the rotary wings. This also assists in overcoming the reduced lift problem.

(5) The utilization of selective stocks of assemblies and spare parts for frequent replacement.

c. Lack of Concealment.--Because of the lack of concealment for helicopters, both airborne and on the ground, emphasis is placed on the use of camouflage paint and nets.

d. Sand Updraft.--The updraft of sand and dust may obscure the entire landing area particularly when large numbers of helicopters are used to land tactical units in areas covered by loose sand. This problem can be considerably reduced by:

(1) The careful selection of landing zones and approaches to take advantage of the sand-free areas that can be found in most deserts.

(2) The timing of waves to permit sand to subside or be blown from the landing zone between waves.

(3) The utilization of many small, separated landing sites in proximity to the objective of the landed troops. Careful selection of such areas is required to ensure the convergence of small unit efforts and rapid concentration on the objective after landing.

(4) Operating helicopters on the ground at reduced power and by making landings and takeoffs as near as possible to selected sites, thus reducing taxiing distances.

e. Navigational Difficulties.--Navigation difficulties caused by the lack of identifiable terrain features on maps are reduced by making sketches showing such recognizable features as the colors of sand or surface materials, the general pattern of sand dunes, craters, and pieces of wreckage.

f. Winds.--Because of high and violent winds common to desert regions, aircraft, when on the ground, are secured with double tiedowns.

4307. EMPLOYMENT OF AIRCRAFT

Aircraft in desert operations are employed in accordance with the tactical principles delineated in FMFM 5-1, Marine Aviation. Tactical air operations are extremely effective in a desert environment. In an area where mobile forces with tanks are the backbone of ground operations, the effectiveness of aerial munitions, coupled with the range and maneuverability of aircraft and the lack of cover and concealment for ground forces, makes air superiority a must for desert operations. The excellent flying weather normally present in the desert allows air units to maintain an unusually high sortie rate if maintenance can overcome the effects of sand and extreme heat.

a. Support of Mobile Forces.--Probably the most effective use of air support of the ground battle in the desert is the support of mobile forces. Such forces, due to their speed and mobility, require flank protection, long-range reconnaissance, column cover, logistic support, and route reconnaissance, all of which may be supplied by aviation. In many situations, air is the primary support available.

b. Air/Ground Planning.--Prior planning between representatives of the ground and air units is mandatory to determine the requirements for aircraft, the times at which aircraft are relieved on station when an air alert is established, the mission assigned the aircraft, and the control agency to which the aircraft report upon coming on station.

c. Operational Problems.--Although air is effective in the desert, the characteristics of the area magnify many problems. Principal difficulties encountered include:

(1) Blowing dust and sand infiltrate all working mechanisms. They may cause the failure of the mechanism or reduce the service life of the equipment. Consequently, great emphasis is placed on squadron level maintenance of aircraft, and there is an increased requirement for spare parts.

(2) Fuel and lubricants (POL) are much more liable to contamination from dust and dirt in the desert. Handling equipment is likewise affected by sand and dust as is all motor transport equipment. Additional equipment and spare parts must be available.

(3) Protective shelters and covers for aircraft and equipment may become mandatory.

(4) Blowing dust and sand adversely affect visibility and operation over any battle area. This is particularly true in battles between mobile forces and battles in which tanks, artillery, and heavy weapons are being used. This factor has a tremendous effect on ground observation, and while it hinders air observation, there are usually holes in the dust cloud through which some observation can be made.

(5) Control of aircraft and air units in a desert operation creates additional problems. Every airfield in the area is prepared to retrieve aircraft by use of ground-controlled approach. Blowing dust, not only from action of the wind, but from the takeoff or landing of aircraft, can place a dust cloud over a field that can completely close the field to operation.

(6) Target designation and description for air attacks in desert areas become most difficult due to the sameness of terrain and lack of outstanding landmarks. Maximum use is made of varied methods of marking targets and of directing aircraft onto the target.

(7) Recognition is also difficult in desert areas. Friendly tanks and vehicles covered with dust are difficult to distinguish from enemy vehicles. Such identifying means as panels or identification pennants on tanks are employed.

(8) Navigation is difficult in desert areas. Additional electronic aids are provided for air units.

4308. EMPLOYMENT OF TANKS

Tanks are a decisive weapon in desert warfare where terrain facilitates rapid movement over great distances. Tank formations can move swiftly around enemy flanks to attack rear areas, cut lines of communication, and surround defending forces. In addition, desert terrain generally facilitates the employment of the tanks' long-range, flat trajectory weapons.

Normally, an increase in tank strength above that required for normal operations is provided to a landing force employed in the desert. Insofar as practicable, tanks are employed in mass with infantry covering them mounted in tracked vehicles. Tank formations disperse in open desert country, then assemble for attack or passage of defiles. At such times, they are vulnerable to air and nuclear attack and are provided with air cover and employ all passive means available. In defensive and/or antimechanized actions, the bulk of the tanks available to the landing force are normally employed as the nucleus of a mobile reserve force. Such a reserve force is generally held until the attacking enemy tanks have been damaged and/or delayed by air, long-range naval gun and artillery fires, and other AT weapons organic to the landing force. Once committed, it employs fire and maneuver to hit the enemy force on its flanks or rear to strike a decisive blow. Tactics employed by tank units conform to the general principles delineated in FMFM 9-1, Tank Employment/Antimechanized Operations. The following factors require special consideration:

a. Mobility.--As a rule, it is easy for tanks to move in desert areas. Movements are normally made for long distances and speed of execution is essential. Maintaining direction during movement is difficult because of the absence of roads, trails, and landmarks. Navigational aids and dead reckoning are required to maintain direction.

b. Surprise.--It is difficult for tanks to achieve surprise in the desert. Tank movement is normally accomplished by dust clouds which can be seen for many miles during daylight. In addition, the lack of natural cover and concealment makes tanks easily spotted by aerial observers. Whenever practicable, tank movements are made at night or in duststorms; although movement at night over unknown ground is slow and control is difficult during duststorms. Surprise is facilitated by the use of aggressive reconnaissance and security forces, speed of movement, and deception. Dummy positions, decoy movements, and the operation of false radio nets assist in deception. The glare of the sun in back of landing force tanks aids in concealing movement and gaining surprise.

c. Security.--Tanks in the desert require all-round protection at all times. When tanks halt, a perimeter type defense is adopted and hull defiladed positions are prepared so that enemy tanks can be engaged from any direction. Reconnaissance extends for greater distances than normal, and tank units are employed with larger reconnaissance forces. Dispersion, concealment, and camouflage are employed as passive measures against hostile air attack.

d. Air Support.--A tank battalion organization does not include a tactical air control party (TACP). When operating independently or as part of a mechanized task force, tank units are assigned TACP's who train and operate with them. Sufficient radios are available in the tank battalion to equip a tank in each company for a forward air controller (FAC). However, since the air liaison officer requires a longer range radio to maintain contact with the direct air support center (DASC), he may have to use his radio jeep for this purpose. The air liaison officer (ALO) operates in close proximity to the tank commander to facilitate the flow of information and keep abreast of the commander's desires.

e. Tactical Restrictions.--Antitank mines and antitank guns impose the principal tactical restrictions on the operations of tanks in a desert environment. Tanks require infantry and engineer support to breach minefields and assault antitank guns.

f. Logistics.--The increased requirement for class III supplies is a major consideration for tank units in the desert. Desert terrain may limit the movement of wheeled vehicles and LVTP's adapted with fuel pods are employed. Fuel may also be prepositioned when security is not a major factor.

4309. EMPLOYMENT OF ARTILLERY

a. General.--The employment of artillery in the desert environment conforms to the principals delineated in FMFM 7-4, Field Artillery Support. Principal problems peculiar to artillery employment in desert warfare are observation, maintenance, and supply.

(1) Observation.--Ground observation is very difficult because of heat waves, mirages, lack of elevated positions, and frequent duststorms.

(a) Distance observed over flat, open terrain is deceiving and is usually underestimated.

(b) The absence of identifiable landmarks reduces the value of maps.

(c) Mirages distort shapes of objects. Ground observation may be completely nullified at 500 yards or less.

(d) In open terrain, sound and flash ranging are particularly effective.

(e) Considerable reliance is placed on SHELREPS (shelling reports), radar, and sound location.

(f) Greater stress is placed upon air observation for target location and fire adjustment.

(2) Maintenance.--Heat, dust, and cross-country movement impose special maintenance problems. Wear on gun tubes, slides, and all bearing surfaces and the scouring and pitting of optical instruments are greatly increased by exposure to these conditions.

(3) Supply.--Increased attention is given to supply support in desert operations. Ammunition supply is a major problem. In order to meet this problem, motor transport of artillery units may be augmented or delivery of ammunition may be accomplished by helicopters or tracked vehicles.

b. Tactics and Plans.--Artillery tactics and plans are varied to suit the conditions of terrain and climate.

(1) Missions are provided to hamper tank movement and to attack shallow personnel emplacements. Fires are scheduled to deceive the enemy as to the direction of attack and to blind observation by smoke. Variable time (VT) fuzes are normally the most effective in counterbattery fires.

(2) Positions in defilade are rarely available. Distance between guns is increased to much greater than that normally used, and guns are echeloned in considerable depth.

(3) In selecting position areas in a desert operation against an enemy which is strong in armor, the utmost antimechanized capability of

the artillery must be utilized. Antimechanized fires are scheduled and maintained for all likely avenues of enemy armor approach; observation is organized to ensure early warning of attack; and ammunition is positioned to permit early, continuous, and damaging attack against armor. A progressive approach is maintained toward the physical location of our artillery.

(4) Lack of vegetation creates camouflage and concealment problems. As a result:

(a) Position areas are dispersed.

(b) Dummy installations are constructed.

(c) Camouflage is used extensively. Nets and other artificial means are required since natural materials are lacking.

(5) The problem of communications and control is aggravated in the desert because artillery positions are spread over large areas.

c. Self-Propelled Versus Towed Artillery

(1) Self-propelled artillery has certain advantages over towed artillery in desert operations. Specifically, self-propelled weapons offer light armor protection for crews and vulnerable parts of the weapon.

(2) Principal disadvantages of self-propelled weapons are their high fuel consumption, increased maintenance problems, and the fact that the loss of the prime mover results in the immobility of the weapon.

(3) In general, towed artillery provided with a full tracked towing vehicle has no particular difficulties moving in desert terrain. However, the disadvantages of fuel consumption and maintenance stated in the preceding paragraph also apply if a full tracked prime mover is employed as the towing vehicle.

(a) Areas which restrict movement (salt marshes, dune areas, and rock outcroppings) can usually be bypassed.

(b) Stretches of deep, soft sand may be encountered anywhere in the desert. The sand is seldom deep enough to prevent the passage of either wheeled or track-laying vehicles, although wheeled vehicles may occasionally get stuck.

4310. EMPLOYMENT OF AMPHIBIOUS VEHICLES

Amphibious vehicles are effective in desert operations. They are suitable for mechanized task force operations. LVT's make a great contribution to the landing force's mobility in a desert environment. The LVT serves as a troop and cargo carrier, and with a fuel pod serves as a refueler. Principal limitations to their employment in the desert result from design compromises necessary to make the vehicles amphibious and the extensive supply and maintenance requirements they generate. In addition, when required to travel with hatches closed during the heat of the day, they are hot and uncomfortable for both crew and passengers. Their employment in the desert conforms to the tactical principles delineated in FMFM 9-2, Amphibious Vehicles. Special considerations include:

a. Mobility.--The desert floor generally is good terrain for the movement of tracked vehicles. Sharp turns and abrupt halts are avoided to reduce the possibility of the vehicles sinking into the sand. Some areas of soft sand may be encountered that require matting to enable amphibious vehicles to cross them.

b. Cooling System.--Maintaining a supply of water for all vehicles is a major consideration. The entire system, including fan operation, is carefully checked prior to and during employment of vehicles in the desert. Adding water, installation of new hoses, and replacement of defective cooling system components are effected as required.

c. Navigational Equipment.--As a minimum, magnetic compasses are installed in all vehicles.

4311. NUCLEAR AND CHEMICAL CONSIDERATIONS IN DESERT OPERATIONS

a. Opportunities for extensive use of chemical agents in desert operations are generally limited. Storage problems for chemical agents will be present because of the extremes in temperature between daytime and nighttime. Since extreme temperature lapse conditions prevail during all sunlight hours, agents dissipate quickly and therefore require high ammunition expenditures.

b. Periods of lapse and inversion, together with prevailing winds, are reliably predictable throughout any given period. Accordingly, the opportunity is present for laying down a concentration of nonpersistent gases on an objective area during a favorable or inversion period and launching the ground assault sufficiently after commencement of the lapse period in order for the agents to have dissipated.

c. Considerations in the employment of nuclear weapons in desert operations will be generally the same as in conventional type operations. Because of the reflectivity of the surface, the effects of thermal radiation may be extended. As a result of intense thermal radiation impinging on a heat-absorbing surface, a hot layer of air is produced. This thermal layer may affect the reflection process of the blast wave to a considerable extent. In particular, the pressure at the wave front increases more gradually but to a lower peak value than in a true shock wave.

4312. EMPLOYMENT OF ENGINEERS

Engineer operations in the desert generally include those normal to temperate climates, but a greater effort is expended on activities made critical by the desert's character. These operations are reconnaissance; installation, removal, or destruction of antitank obstacles; development of potable water points; and the construction of facilities, fortifications, and roads.

a. Water Supply.--Water supply is the most important single mission of engineers supporting a desert operation. Water consumption requirements and data are presented in appendix G. The search for water sources requires continuous and intensive reconnaissance. In some areas, water may be obtained by deepening dry wells or by digging into the beds of dry watercourses. Provision is made for storage of water at waterpoints and wells. With special apparatus for distillation, the water from salt or alkaline ponds and marshes may be made drinkable. Because troops are widely

dispersed in desert operations and waterpoints are few, transportation of water over long distances becomes necessary. Sometimes pipelines are used; however, in fast-moving situations, hauling water is more practical. This method of delivery requires that additional tanks, trucks, and trailers be provided to logistic units. Water can be moved by aircraft to remote areas in palletized loads and large collapsible containers.

b. Offensive Operations.--During the offense, engineer operations and facilities are well forward and engineer support is closely integrated with the supported unit. Close coordination and integration is required because of the absence of a continuous line of contact and because of the fast-moving maneuvers employed. Individual tasks are relatively small and simple. On the other hand, the combined work total exceeds normal requirements. Emphasis is on speed and control of operations over extended areas. Bridging, both fixed and floating, is required occasionally at points of terrain or along routes of communication. Security measures are taken against enemy air and ground action. Since large minefields can be installed or altered quickly, thorough and constant reconnaissance for mines and obstacles is necessary before an attack. Antitank obstacles are breached before an armored attack is made. Engineers accompany the breaching force.

c. Defensive Operations.--In the defense, engineer facilities are disposed in depth. Equipment available to supporting engineers are useful in helping troops dig in their vehicles and equipment. Trucks are dug in up to the hoods and tanks are dug in up to the top of the tracks to reduce the height of their silhouettes and to provide protection from artillery fire. Lack of natural concealment requires that special emphasis be placed upon camouflage measures. Camouflage of large installations defeats its own purpose, but deceptive measures such as dummy installations assume increased importance.

d. Retrograde Operations.--In retrograde movements, the destruction of water sources and stocks of fuel and water is important. Wells and pipelines are destroyed if feasible and possible, otherwise, water sources which cannot be destroyed are contaminated. The extent of destruction, as in all denial operations, is governed by the directives of higher authority which consider plans for the possible future use of the area. Engineers are prepared at all times to execute such destruction or contamination.

e. Mines and Obstacles.--The comparatively small number of troops in an area, the limited number of natural obstacles, and the extended area of operations dictate the employment of mines. Small minefields are of little use since they, like other obstacles, are easily bypassed. Extensive minefields are used to canalize enemy movements into areas where other obstacles may then prove effective. Formidable natural barriers are sometimes present in the form of rock escarpments. Major mine operations are directed toward key terrain features, manmade facilities, and natural resources critical to the enemy force.

f. Destruction or Denial of Water Sources.--Destruction of the enemy's water sources can reduce his effectiveness and limit his advance more effectively than any obstacle. Known enemy water sources are top priority targets for air attack. To deny these sources, antipersonnel mines and delayed action mines may be used.

g. Ground Control.--A desert area normally has little or no existing ground control, and special consideration is given to the required survey support for artillery, missile, and other using units.

Section IV. LOGISTICS AND COMMUNICATIONS

4401. GENERAL

The effectiveness of landing force units in the desert depends to a large degree on the combat service support available. Equally, their vulnerability lies in their exposed lines of communication and the immobility of their bases of supply and support. Logistic support for landing force units in the desert differs from normal operations in the following respects:

a. Logistic operations extend over far greater areas.

b. Dispersion of landing force units dictates a greater degree of unit self-sufficiency.

c. Increased requirements for mechanized/motorized equipment, and the adverse effects of the desert environment on such equipment, generate increased requirements for spare parts and maintenance.

d. The consumption of fuels, lubricants, and water is greater when moving cross-country in the desert than in any other type of terrain.

e. Battlefield recovery of vehicle casualties presents special problems because of distance between units and the necessity for cross-country movements. Breakdowns on a march, particularly of patrols or other small units, present special problems.

4402. SUPPLY

One of the most important facets of desert combat service support is reduction of supply and resupply to essential requirements. However, desert operations generate additional requirements for some types of supply. As one example, personnel require special issues of lightweight clothing, additional water cans, and mosquito netting. While landing force elements participating in a desert operation are usually moved forward by ground vehicles, the feasibility of supply by air is considered. Highly mobile supply points are established using supply point, truck-to-truck distribution procedures.

a. Class III.--Desert operations are characterized by movement and wide frontages which require major emphasis on class III(W) resupply. A commander plans not only for his immediate needs but for his long-range requirements at increased distances. Fuel consumption data and requirements are presented in appendix G. As supply distances increase, it may be necessary to request additional tankers. By providing class III(W) distributing points well forward, tankers refuel unit vehicles quickly. Using tankers for refueling is desirable, but a commander must be prepared to provide his unit with adequate class III(W) resupply by using 5-gallon cans if necessary. This method of resupply requires additional transportation.

b. Security.--Security is a continuing problem in any supply operation. Combat service support installations and supply columns provide desirable targets and are susceptible to enemy attack. In desert operations,

the lack of cover and concealment for such installations and the length of supply lines emphasize security requirements. Providing local security places greater demands on the personnel operating the installations. Commanders give consideration to providing security reinforcements for combat service support activities, particularly in fast-moving situations. Resupply is accomplished during hours of darkness where possible.

4403. MAINTENANCE CONSIDERATIONS IN DESERT OPERATIONS

The peculiarities of operations in the desert place emphasis upon maintenance and operational responsibilities of small landing force elements and individuals. Improper practices in the operation of equipment are costly in terms of personnel and equipment losses. Operators are trained to know the capabilities and limitations of the equipment in relation to this terrain. Common sense and the careful operation of equipment is the key to extending its life and usefulness. Field expedients are used whenever practicable to overcome emergencies arising from conditions of terrain, climate, mechanical deficiency, or breakdown. These include assisting vehicles in crossing obstacles, extracting them from difficult sections of terrain, and reclamation and towing of disabled vehicles.

a. Operator Training.--Because of the general absence of established roads in desert areas, desert driving calls for experience, individual skill, and physical endurance on the part of vehicle operators. Driver training exercises are long and arduous to expose vehicle operators to the rigors of the desert as well as to test the effect of fatigue on the individual in a desert environment. The need for dispersing and avoiding the tracks of preceding vehicles--when operating over crusted surfaces or when the trail deteriorates while operating over sand (except in suspected mined areas)--is stressed. Training is directed toward developing driver proficiency in operating in dune areas, choice of the best ground, selection of proper gear ratios, and toward driver knowledge and appreciation of the exact capabilities of his vehicle. Driver skill is developed in taking maximum advantage of momentum, gear shifting, estimating and utilizing proper speeds, and in avoiding sudden driving or braking thrust. A checklist for vehicle maintenance is presented in appendix H.

b. Maintenance of Equipment.--Desert terrain and weather present constant problems in maintenance and increase the maintenance time required per hour of operation.

(1) The extreme heat of the desert is a constant threat to the operation of internal combustion engines. The necessary heat dissipation through the cooling and lubricating systems is retarded by high external temperatures. The cooling and lubrication systems depend upon each other; a malfunction within either affects the other. Evaporation of liquids is rapid. The deterioration rate of plastics, rubber, synthetics, and insulation is high.

(2) Water economy is very important. Water for cooling systems is considered in the overall water requirements when movement is anticipated. Cooling systems are checked frequently for leaks and obstructions which might impair the function of radiators. For each pound of pressure within a water-cooled system, the boiling point is raised 3 degrees Fahrenheit. It is, therefore, important that radiator pressure caps function properly. Fan belts deteriorate whether in use or in storage. To determine the serviceability, remove the fan belt, turn it inside out, and compress the end of the loop. If the belt has deteriorated, it will break or crack.

(3) Batteries are given special consideration because of the heat of the desert. Distilled water for storage batteries is stored in glass or canvas containers rather than in metal cans. In hot areas, the self-discharge rate of batteries is higher and sulfation rate is more rapid. Therefore, batteries are checked frequently to ensure that the charge and specific gravity of the electrolyte meet required standards. When activating dry-charged batteries, proper procedures are followed. Overcharging batteries evaporates the water more rapidly. Regulators are set to the lowest possible charging rate consistent with overall requirements. Batteries are not stored near rubber products because the acid fumes are harmful to the rubber.

(4) Oils and lubricants are checked for proper viscosity and level frequently.

(5) Heat from direct sunlight has adverse effects upon plastics, rubber, lubricants, and pressurized gases; for example CO_2 (carbon dioxide) fire extinguishers must be kept out of the direct rays of the sun or else automatic discharge occurs because of the increased pressure. Tires, fan belts, batteries, optical elements, and other material affected by heat are stored out of the direct rays of the sun.

(6) Depending upon the reflective qualities of terrain, the surface temperatures can be considerably higher than the atmospheric temperatures; and because of proximity or actual contact with hot surfaces, tires, cooling systems, lubricants within gear housings, crankcases, and moving parts are affected.

(7) Communication equipment and fire control instruments are damaged by dust, sand, and condensed moisture. Fine grit blown by strong winds wears off paint and other protective coatings. Wire insulation is often damaged and loses its protective qualities. Optical instruments become scoured and pitted when constantly exposed to the elements. Constant care is necessary to keep this equipment in good operating condition.

(8) Windblown sand and dust generated by local movement or agitation increases preventive maintenance problems. The problem of "eating the dust of others" by individuals or units within the group movement can be minimized by dispersion, increased interval, and consideration of wind direction.

(9) Air filters are checked frequently. During group movement, the air filters are checked as often as required--at least every 75 miles of travel. All hoses and connections of the air-fuel induction system must be tight and in good condition. Sand and dust entering the system can completely destroy an engine within less than 50 miles of travel.

(10) Every precaution is taken to prevent sand and dust from entering crankcases and gear housings and combining with the lubricant. Filler and dipstick caps and gaskets must be in place and in good condition. Oil filters and lubricants require frequent inspection and replacement. Precautions are taken to guard against sand and dust entering into containers and dispensers.

(11) Linkages and constant-velocity joints are oiled and wiped dry. Covers are used and, where necessary, improvised to protect exposed areas. A minimum of grease is used on battery terminals to facilitate

frequent cleaning. More frequent lubrication of moving parts through grease fittings is necessary because of the capillary action of sand and dust.

(12) In dry, dusty, or sandy areas, the exposed surfaces of weapons, such as recoil slides, are left dry rather than oiled since contamination of the lubricant with sand forms an abrasive paste and is far more damaging than operating with dry surfaces. Covers are used to prevent sand and dust from entering the breech, muzzle, and operating parts.

(13) When maintenance or repair of equipment requires dismantling or opening any assembly, care is taken to protect the exposed assembly from sand and dust. The leeward side of natural or improvised shelters are used to shield the equipment from dust laden winds. Exposed material awaiting maintenance or repair is covered to protect it from sand and dirt.

(14) One of the phenomena of the desert is the high degree of static electricity. This is caused by atmospheric conditions conducive to the induction of static electrical charges by the friction of the wind, sand, and materials. Because of the dryness of the terrain, these charges may not "ground out" through ground devices. Clothing and material may have a difference of electrical potential or unlike charges. When contact is made between them, a spark may occur. When inflammable gases are present, ignition occurs and a fire or explosion results. External load operations by helicopter crews are seriously hampered by static electricity. Hookup is hazardous, and danger of fire and/or explosion in oil and ammunition loads exists.

(15) To eliminate the hazards of fire during refueling operations, a metallic circuit is established and maintained between the containers before and during fuel transfer; i.e., the circuit links the container dispensing fuel to the container receiving fuel.

(16) Friction with constant electrical discharges within a cargo can cause combustion.

c. Contact Repair Teams.--Contact repair teams are made available to forward units because of the importance of maintenance in the desert. In the attack, these teams follow elements closely to ensure quick repair of damaged vehicles and weapons, and they perform controlled exchange as necessary.

(1) A vehicle recovery standing operating procedure is established as soon as possible. The responsibility for recovering and evacuating vehicles from the battlefield is from lower units to higher. A unit unable to recover a vehicle reports the location and condition to the maintenance crew of the next higher unit. Guides are furnished to the recovery crew by the unit concerned. Security personnel accompany the crew if necessary.

(2) To facilitate the recovery and evacuation of vehicles:

(a) A collecting point is established from which division maintenance crews can evacuate vehicles.

(b) A thorough plan is made before a recovery operation is started.

(c) Only the numbers and types of vehicles suited for a particular job are taken along.

d. Weapons.--Windblown sand damages weapons; therefore, adequate measures are taken to avoid permanent damage to their operating parts. Muzzles and other apertures are protected with suitable covers, and weapons are cleaned more often than in other terrain. Individual weapons are disassembled and cleaned with a dry cloth at least once a day. Mechanics and weapons crews inspect tubes, slides, and bearing surfaces periodically to detect abrasions. Stored weapons, which cannot be cleaned daily, are covered with a protective coating of grease. The care and cleaning of all weapons is supervised carefully by small unit commanders, and commanders at all echelons inspect to see that proper first echelon maintenance is being carried out.

4404. MEDICAL

The large area over which a battle is fought presents special problems to the evacuation and treatment of casualties. Any number of casualties in a highly mobile unit restricts its activity and may endanger that unit. Medical personnel are furnished a greater number of vehicles than in other terrain. Medical installations at all echelons are farther to the rear than normal. Air evacuation by fixed-wing aircraft and helicopter is particularly valuable because of its speed and the reduction of load on organic vehicles. Larger aircraft are also used to evacuate casualties from collection stations and field hospitals.

4405. COMMUNICATIONS

Dust and sand, mirages, and heat hamper communications and have an adverse effect on communication equipment in the desert. Duststorms damage unprotected equipment and make it difficult for maintenance personnel to work in the open. Mirages occasionally make visual communications unreliable and cause distances to be miscalculated.

a. Wire.--Wire is not employed extensively in desert operations except in rear areas and in stable situations because of the great distances involved. When wire is used, its use is planned carefully and every effort is made to avoid laying it prematurely. Normally, it is laid at night. When possible, wire is overheaded or buried, since tracked vehicles damage surface lines. When wire is buried, its location is marked and the wire routes are plotted on the map. Although standard wire and cable are well insulated against the heat, it is necessary to inspect the insulation frequently to detect deterioration. It is also necessary to do more than normal wire maintenance.

b. Radio.--Radios form a major portion of the communications employed by the landing force in a desert operation. This is particularly true in fast-moving situations. In consideration of the terrain conditions and increased distances between units, greater emphasis is placed upon the employment of air-ground relay or ground-relay radio installations. Pack and vehicle-mounted radios are easily damaged by sandstorms. Radio equipment covers are kept on to reduce sand damage and to assist in protecting the sets against extreme temperatures. The supply of dry cell batteries is increased to offset the high attrition rate caused by exposure to extreme temperatures and direct sunlight. Electrical grounds are poor in desert terrain since the surface soil lacks moisture. This poor grounding reduces radio communication range unless a counterpoise is used.

(1) Radio antennas are located on high ground above the surrounding terrain. The best communication range for 2 to 30 MHz frequencies is obtained by using a counterpoise and locating the antenna near oasis or subsurface water (salt marshes).

(2) Whip antennas lose one-fifth to one-third of their normal range in desert terrain, therefore, complete antenna systems such as horizontal dipole antennas and vertical antennas with counterpoises are used.

c. Messengers.--Foot messengers are normally impracticable in desert operations because of the great distances between units and the extreme heat. Motor and aircraft messengers are used extensively. They are trained in navigation because of the lack of recognizable landmarks.

d. Visual and Sound.--Visual communications are generally effective over longer distances although heat mirages and duststorms sometimes temporarily impair or restrict their use. The distances involved, rapid movement, vehicular noises, storms, and the need for security hamper sound communications.

CHAPTER 5

JUNGLE OPERATIONS

Section I. GENERAL

5101. INTRODUCTION

Amphibious operations in a jungle environment are conducted in accordance with the general tactical principles and procedures delineated in LFM 01, Doctrine for Amphibious Operations, and LFM 02, Doctrine for Landing Forces. Such procedures are modified as necessary to cope with extremes of the environment. Subsequent operations in jungle terrain include many of the types of combat that are considered as special operations; i.e., combat in mountains, river crossings, and the assault of fortified areas. Difficulties of terrain, vegetation, weather, and visibility complicate problems of command, movement, and supply to the point where normal methods may have to be modified and special equipment employed. As a result, the pattern of fighting is one of small unit actions in which automatic weapons teams, reinforced squads, platoons, and companies strive to eject the defender from his positions. These small units fight chiefly with the weapons and equipment carried on their backs. Assault elements of the landing force seek to avoid jungle areas insofar as practicable. When feasible, such areas are skirted on either or both flanks. Concurrently, the defenders' observation and weapons are neutralized by smoke and flanking or enfilading fires. When avoidance of a jungle area is impossible, assault elements of the landing force endeavor to mount their main attack in the form of an envelopment with a frontal attack as a supporting effort. When this is not feasible, assault elements resort to a penetration as the main effort. This chapter outlines the tactics and techniques employed by a landing force in such operations. The U.S. Army discusses such operations in detail in FM 31-30, Jungle Operations.

5102. JUNGLE AREAS

Jungle areas of the world are depicted in figure 33. These areas may be categorized in terms of terrain, vegetation, weather, plant and animal life, and manmade features.

a. Terrain.--Most jungle terrain is rugged, with swamps, deep valleys, and steep ridges. Rivers and streams are plentiful because of heavy rainfall. Heavy water runoff breaks down mountains into hills and ridges. Soil is soft, and footing on steep slopes is difficult. Conditions conducive to landslides and soil creep are found in many areas where slopes are steep and wet. Trails tend to follow ridges, often making detours to avoid low ground and deep valleys.

b. Vegetation.--The most dominating characteristic of the jungle is vegetation. General classifications of vegetation include: rain forest, deciduous forest, and Savanna. Vegetation is best described in terms of specific areas; i.e.:

(1) Coastal thickets are encountered along sandy beaches, usually just above tidal level. Such vegetation is thick and attains heights of 30 feet or more. Movement through these areas is slow and difficult.

(2) Mangrove swamps are found in areas between low and high tide. This vegetation varies in height ranging from a few feet to 70 or

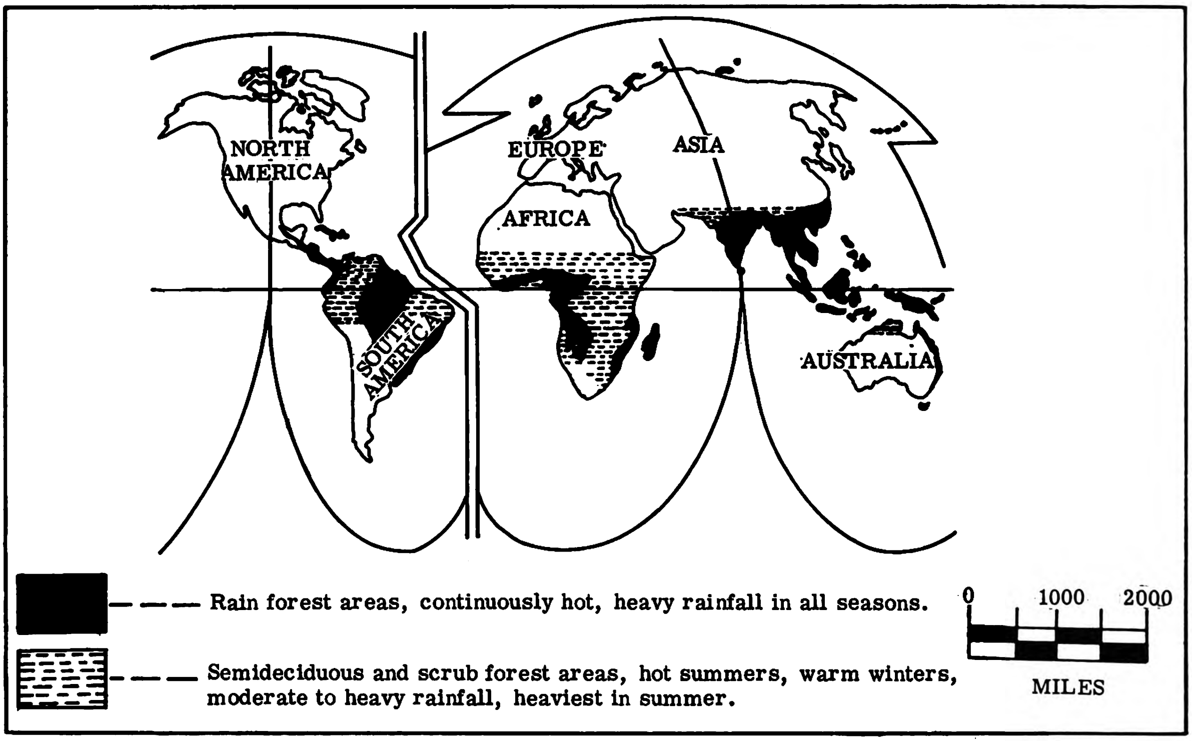


Figure 33.--Jungle Areas of the World.

more feet. Trees are characterized by massive aerial roots. These trees grow close together. The obstacle they create is one of the most serious encountered in the jungle.

(3) Vast areas of palms and ferns are encountered along rivers and streams that overflow their banks. These palms vary from thick nipa palms 5 to 8 feet in height to giant palms 70 feet in height. The fern type of palm favors areas that are covered with water only part of the year. Undergrowth in areas of tall palms varies from dense to scattered small shrubs and bushes. Generally, movement is restricted to the column.

(4) Large trees forming a closed canopy at heights of 80 to 150 feet occupy areas slightly above swamp level to the tops of hills. They black out daylight, and the forest floor is dim and covered with a matting of decayed vegetation. Undergrowth varies in density. Movement is generally restricted to column formations.

(5) A dense thicket of shrubs and small trees occurs along the shallow banks of wide rivers and streams that do not overflow their banks.

(6) Tall trees with straight trunks branching out only at the top are common on hills and mountains. The height of trees decreases on mountains of high elevation.

(7) Savanna grasslands, the tropical equivalent of the prairies of the temperate zone, are characterized by extensive areas of grass ranging in heights up to 12 feet or more with scatterings of low trees and small forests along the water courses. Movement through the Savanna is slow and difficult. Visibility is practically nonexistent.

(8) Secondary growth exists in all major jungle areas. Many abandoned agriculture clearings are occupied by dense, fully developed secondary growth consisting of shrubs, thorned vines, bushes, and trees. Movement in secondary growth areas is extremely difficult and slow. Extensive cutting may be required to move at all.

c. Weather.--Jungle weather is usually hot, humid, and subject to sudden changes. Within a short period of time, hot clear weather may change to a torrential rainfall. Such rainstorms are generally brief, violent, and characterized by intense thunder and lightning. With equal suddenness, the rain may cease and the sun shine. Maximum relative humidity is produced by the heat of the tropical sun evaporating large quantities of water from lakes, rivers, streams, and damp jungles.

(1) Equatorial.--Generally, there is a continuous rainy season along the equator. Away from the equator, there are distinct wet and dry seasons. The dry seasons become prolonged on the outer margin of the tropical areas of the jungle. The area located within 25 degrees north and south of the equator is referred to as the wet tropics. The tropical areas extend to approximately 30 degrees north and south of the equator.

(2) Seasonal Changes.--Seasonal changes are noticeable in jungle although not pronounced. While the weather is usually hot and humid, it can be cool and even cold during the nights. Annual rainfall is greater on the windward side of a continent or island than on the leeward side.

d. Plant Life.--Plant life as a source of food for survival exists in the jungle. Wild fruits, nuts, and plants are abundant. A vast number are edible, although some are more palatable than others. Plants are more common than animals and are easier to obtain. Personnel operating in such areas should make an extensive study of the edible plants of the area.

e. Animal Life.--Animals which are dangerous to man are the exception. They are rarely seen in the jungle. Normally, they will flee from man. When cornered or wounded, they may attack or even kill. All family groups of the animal kingdom are represented, with some groups numbering thousands of different species.

f. Manmade Features

(1) Roads.--There are few roads or trails in jungle areas. Usually roads have to be constructed, and their use is limited to light trucks or light tracked vehicles. Except for coral in some coastal areas, there is a lack of materials suitable for road construction. The dense vegetation, unstable soils, and poor drainage make roadbuilding difficult. To establish and maintain a road net of even minimum standards calls for greater engineer effort than in other types of terrain. Navigable waterways often provide the most efficient routes of communication, although they are highly vulnerable to ambush.

(2) Bridges.--Bridges suitable for military loads rarely exist in jungle regions. The construction of bridges is complicated by the frequency and intensity of flash floods, the tendency of some jungle streams to shift their courses, and the rapid decay of wooden structural members.

(3) Built-Up Areas.--Towns and villages in jungle regions rarely provide suitable facilities for military installations. Usually settlements are found along tropical coasts, but there are very few water terminals sufficiently developed to be of much value in military operations.

5103. EFFECTS ON LANDING FORCE OPERATIONS

Jungle vegetation, swamps, rivers, streams, and broken ridges hinder both fire and maneuver. An enemy can be expected to take full advantage of these natural obstacles in planning beach positions and supplementing them with manmade obstacles. In planning amphibious operations in a jungle environment, maximum use is made of available intelligence terrain studies to determine the military characteristics of the projected area of operations.

a. Organizational/Equipment.--Amphibious operations in jungle terrain normally require reorganization and changes in equipment. Changes in organization and equipment are dependent upon the characteristics of the proposed area of operations. In general, the more underdeveloped the area, the more changes that are necessary. Factors considered in providing for the adjustment of equipment include:

(1) Only vehicles and equipment required to fulfill combat and logistic requirements of the landing force are landed. Light vehicles are substituted for heavier vehicles, insofar as practicable. This minimizes trail maintenance, reduces POL requirements, and facilitates concealment and security at the halt.

(2) In dense jungles, mortars provide a greater percentage of close fire support. Increased reliance on the mortar reduces transportation requirements and permits more rapid movement and emplacement in restricted terrain.

(3) Typical jungle targets such as bunkers and crew-served weapons can be effectively engaged by weapons such as grenades, rocket launchers, flame weapons, light assault antitank weapons, recoilless rifles, and grenade launchers.

(4) Ground radars have limited value in jungle area. They are line-of-sight and cannot penetrate dense undergrowth or trees. They can, however, provide early warning on trails, streams, or any other avenue of approach which allows line-of-sight employment.

(5) Once the landing force moves into heavy jungle, normal vehicular movement of supplies is curtailed. Loads are lightened and improvised means planned to ensure the continued flow of supplies forward. Native porters can carry up to 40-pound loads for 6 to 7 hours depending on the terrain and trail conditions. When aircraft and/or helicopters are available, they may be employed for resupply purposes.

(6) Engineer effort is initially required for trail making. As the landing force continues to move cross-country, more maintenance and construction of trails are required to ensure continuous movement of vehicles and supplies. When trails are required to handle sustained traffic for heavier vehicles, additional heavy engineer equipment is needed to widen and ditch trails. Light tool sets, portable power tools, and chain saws are particularly useful for jungle clearance and road construction.

(7) Rapid deterioration of clothing in tropical climates makes it necessary to have additional items on hand or immediately available to the needs of the troops. Special items of issue and additional organizational equipment may also be required. Machetes are provided to assault elements. Increased allowances of light antitank assault weapons and flame weapons are provided for neutralizing bunkers.

b. Command.--While unity of command is continually maintained, the characteristics of the jungle necessitate decentralization of control. Leaders of small units are thoroughly trained in leadership and self-reliance. Every individual is thoroughly briefed on the mission of his unit.

c. Tactics.--The jungle offers so much concealment and limits visibility to such an extent that surprise in the attack and defense may be exploited to an unusual degree. Formations are more compact and similar to those employed in normal night operations. To maintain control and direction, small columns are used almost up to the point of actual combat. Restricted maneuver tends to limit objectives.

d. Key Terrain Features.--In jungle areas, key terrain features are generally those that provide control of trails, navigable waterways, and beaches suitable for amphibious landings. Possession of the edges of an area of high jungle growth provides observation and gives advantages similar to those of high ground in wooded areas or in the edges of woods in forest regions.

e. Observation

(1) In the jungle, the dense vegetation often limits observation to very short distances. Usually the canopy in a primary rain forest, which consists of a virgin growth of mature trees, is so thick that it cuts off most sunlight and visibility is limited to 20 or 30 meters. Visibility may be limited to 5 meters or less in the secondary forest, which is composed of a second growth that develops when the original forest has been burned off or cut. Rain, clouds, and the steamy exhalation from wet areas also tend to reduce visibility. Because of the limited visibility and the lack of conspicuous landmarks, it is often difficult to locate a ground position from a map.

(2) Because observation is limited, tactical units employ narrow frontages, reduce distances and intervals between elements, increase patrol activity, and use a larger number of liaison personnel than required in more open terrain.

(3) Difficulties of observation greatly restrict the employment of supporting arms and weapons. Artillery forward observer teams usually cannot see the burst and must adjust fire by sound spotting and sound sensing methods. Data based on maps or photomaps can be used only to a very limited extent.

f. Fields of Fire.--Since natural fields of fire are generally limited to 5 or 10 meters, lanes are cleared. When the undergrowth is heavy, several days of labor may be required to clear 100-meter fire lanes around positions. This work is expedited by employing portable power cutting tools and/or herbicides and defoliants. Primacord is often effective in hasty clearing of fire lanes. When tanks or LVT's are operating in the area, they may "break trail" through all but the most heavily wooded jungle, since much of the tree growth is shallow rooted.

g. Concealment and Cover.--Jungle growth provides concealment from air and ground observation. Where it is dense, it may furnish some cover from small arms fire. High grasses, such as Kunai, provide concealment but readily reveal any movement. They provide no cover. The amount of cover given by slit trenches and other field fortifications is often limited by the high water table, which prevents excavating more than a few feet below the surface of the ground.

h. Avenues of Approach.--There are abundant avenues of approach offering cover and concealment in the jungle, but they are difficult to traverse because of vegetation. Existing trails and roads canalize movement and facilitate the use of mines and ambush tactics. Waterways often offer good avenues of approach.

i. Obstacles.--Terrain and vegetation found in the jungle are formidable obstacles. However, there are no impenetrable jungles, no unfordable rivers, no impassable swamps, or unscalable cliffs. All avenues of approach, regardless of obstacles, are considered. To consider a natural obstacle impassable is to invite disaster or to overlook opportunity.

j. Movement.--Cross-country movement in the jungle is slow and difficult. (See figs. 34 and 35.) Troops may have to cut their way through continuous thick undergrowth and tall grass or make lengthy detours to by-pass swampy areas. On some jungle trails, troops may have to move in a column

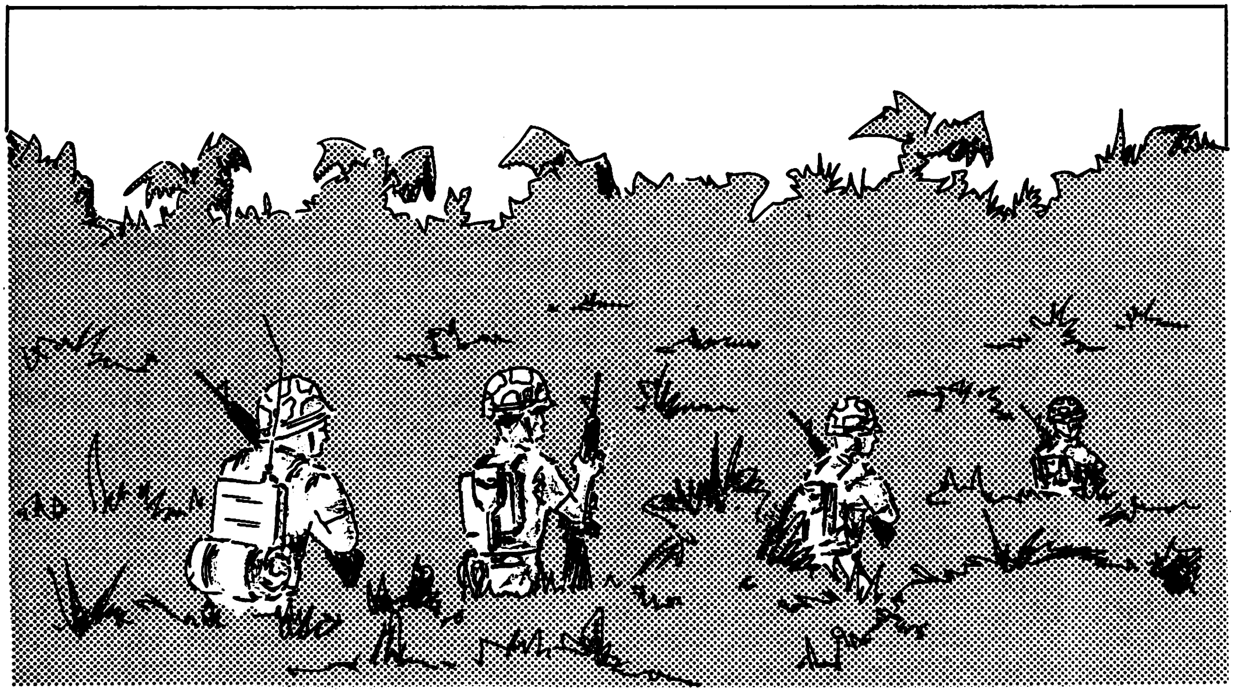


Figure 34.--Movement Slowed by Swamps and Jungle.

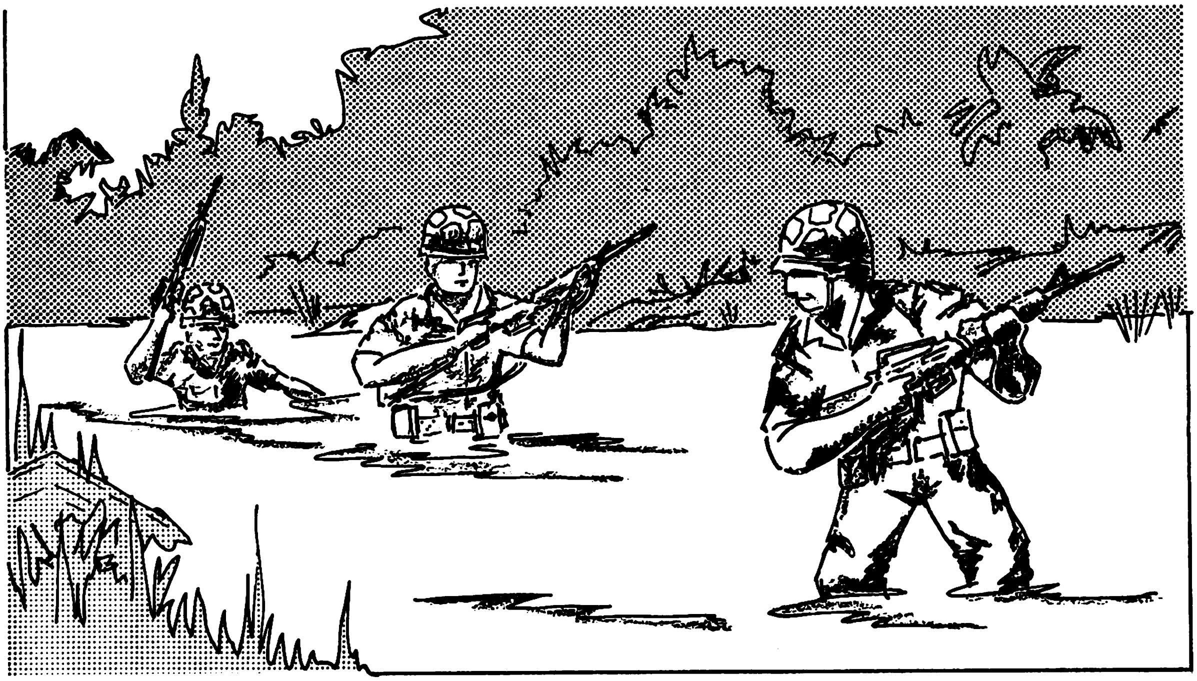


Figure 35.--Movement Slowed and Canalized by Rivers and Streams.

of files. In such cases, the average rate of movement rarely exceeds one mile per hour.

(1) Foot movement is least restricted on ridges where the vegetation is more open and the better drainage results in less mud. Except for small, fast streams with traversable beds, movement is poorest along the banks of rivers because of the dense vegetation, mud, swamps, and tributary streams.

(2) Even in comparatively dry weather, mud slows down vehicular traffic in the jungles. It may be necessary to supplement motorized transport with pack animals and carrying parties.

(3) Jungle roads and trails are overgrown rapidly unless they are in constant use. Trails indicated on maps generally exist, but extensive reconnaissance and/or clearing may be necessary to locate them and put them in use. Air photographs of large areas frequently indicate obvious points on trails. Ingenious interpretation of such photographs can frequently interpolate the paths of the entire trail.

k. Supporting Arms.--The employment of heavy infantry weapons and artillery is hampered by their bulk and weight; by the lack of trafficable roads, soft soil, dense growth of trees, and thick undergrowth; and by limitations imposed on observation and visibility. Cleared sites for indirect fire weapons are difficult to obtain. They may have to be cut out of the jungle. As a result, they are usually small and compact.

l. Effectiveness of Weapons.--In jungle warfare, the most effective weapons are those that are easily supplied with ammunition and are readily transportable over difficult terrain. Suitable weapons include mortars, machineguns, automatic rifles, and grenades.

(1) Tanks and LVT's cannot move through heavy jungle unless routes have been reconnoitered. Usually their movement is limited to beaches, coconut groves, grass fields, and improved trails. The principal value of tanks is in the use of their direct-fire weapons, and crushing weight in the destruction of enemy bunkers and field fortifications. All mechanized vehicles are highly vulnerable to ambush and close-in attack in jungle terrain.

(2) Heavy vegetation reduces the effective bursting radius of artillery and mortar shells. Weapons of 105mm or higher calibers may be employed to blast away jungle undergrowth and destroy enemy positions. When feasible, they are drawn by tractors that can ford small streams. Engineer support is required for the improvement of trails, construction of firing positions, and clearing of fields of fire.

(3) Tactical air operations are effective in close tactical support of ground elements, but their utility for tactical bombing is less than in other types of terrain.

(4) Weather and terrain conditions in jungle areas facilitate the employment of chemical agents. Where the overhead canopy is very dense, however, sprays from aircraft usually are only moderately effective against personnel. The large scale use of defoliants increases the fields of fire of weapons.

m. Logistics.--Logistic problems in jungle operations are caused by rapid deterioration of all classes of supplies, difficulty in movement, the difficulty of keeping supply and distribution points close to assault elements of the landing force, the increased need for preventive medicine, and the necessity for supply economy on the part of all individuals. Proper security of logistic installations is a continuing requirement since jungle conditions are conducive to infiltration, guerrilla action, and raids.

n. Communications.--Visual signaling is seldom effective in the jungle because of the dense growth. The use of messengers is slow and may be hazardous. Wire circuits are hard to install and maintain. The range of radio sets is greatly reduced by the vegetation, resulting in ranges from 40 to 70 percent less than those considered normal in open or lightly wooded terrain.

5104. AMPHIBIOUS CONSIDERATIONS

In applying the principles of amphibious operations delineated in LFM 01, Doctrine for Amphibious Operations, and LFM 02, Doctrine for Landing Forces, commanders recognize the influence environmental extremes exert on tactical operations. Basic decisions, the preparation of staff estimates, and the development of landing force plans are influenced continually by three broad, interrelated factors: the physical environment of the objective area including terrain, hydrography, and weather; the enemy situation; and the inherent and prescribed conditions of the operation. Considerations which require examination prior to launching an amphibious assault against a jungle coastal area or tropical island include:

a. Beaches and Landing Areas.--Beaches and landing areas for an amphibious assault in a jungle should be sufficiently large to facilitate the development of the landing force's combat power ashore, offer good trafficability, have sufficient beach exits, and provide ready access to an axis of communication that can support the landing force's scheme of maneuver ashore. Normally, the availability of such beaches in a jungle area is extremely limited. In addition, poor soil trafficability and heavy vegetation present serious obstacles to troops and vehicles of the landing force. As a result, beaches and landing areas are generally smaller in size and restrict mobility to a greater degree than those selected in open terrain. (See fig. 36.) Amphibious planners overcome this restriction by adjusting landing force equipment in consideration of the landing area, using multiple landing areas whenever feasible, placing increased reliance on aircraft and helicopters as logistic vehicles in the early stages of the operation, employing floating dumps, and landing engineer equipment early to clear beaches, exits, and routes of communication. A landing in the vicinity of a river is sometimes desirable inasmuch as a navigable river provides a readily available axis of communication.

b. Selection of Tentative Date and Hour of Landing

(1) Except in areas of equatorial jungle where there are no dry seasons, jungles have two predominant seasons, dry and rainy. The volume of rainfall is the most important factor. Two hundred inches of rain are not uncommon in a year. During dry seasons, it is not unusual for two or more months to pass with no precipitation whatsoever. In certain cases, the lee side of islands may be barren due to a lack of rainfall. Prior to or just after the rainy season is the best time to conduct amphibious operations. Better weather conditions during the dry season also provide for better air support in conjunction with the landing.

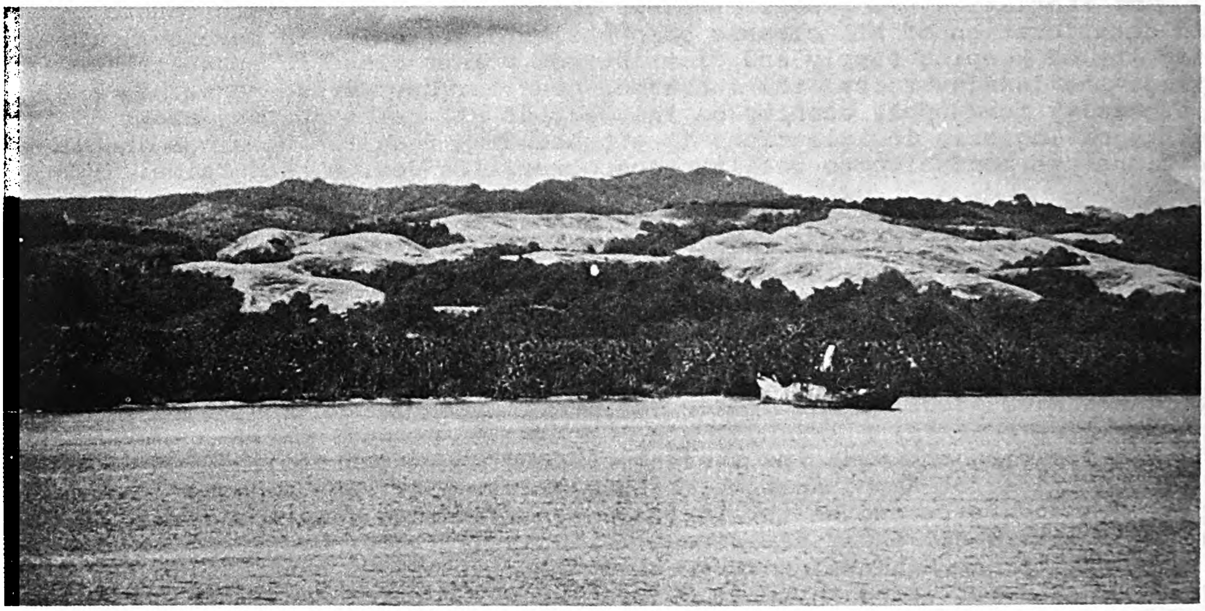


Figure 36.--Typical Jungle Beach.

(2) Except for heavy ground fog, which may linger for several hours after sunrise during the rainy season, early morning landings are superior to other times of the day. Under the heavy canopy of trees, darkness comes to the jungle early in the evening, and while landing force units maintain the capability of conducting night combat, these operations are limited.

c. Subsidiary Landings

(1) Jungle coastal areas and tropical islands frequently lend themselves to a greater anticipated commitment of forces for subsidiary landings than other areas. The capture or denial of offshore islands or adjacent islands and mainland areas to support the main landing or for airfields, early warning installations, and safe anchorages are important considerations. The subsidiary landing may also be conducted for cover and deception of the main assault.

(2) Since mobility is restricted ashore, subsidiary landings leapfrogging up the jungle coast and passing fixed enemy positions can lend mobility to an otherwise static situation. Such landings may be conducted as shore-to-shore operations or as separate landings by other forces.

Section II. SURVIVAL IN THE JUNGLE ENVIRONMENT

5201. GENERAL

Realistic training is conducted to prepare individuals and landing force units to function, fight, and live effectively in a jungle environment. Training guidelines enumerated herein may be applied to jungle-type terrain (woods, rivers, swamp areas) to capitalize on available facilities and time prior to an actual movement to a jungle area of operation in preparation for training or combat. Training for jungle operations is presented progressively. It has two main objectives: first, the mental and physical conditioning of the individual; and second, indoctrination in and application of jungle tactics and techniques. This training is generally divided into three phases. The very nature of jungle operations with their semi-independent actions makes it imperative that all phases of training place great emphasis on the development of initiative in small unit leaders.

a. Phase 1.--Phase 1 is devoted to individual indoctrination and training. The schedule during this phase is based upon the amount of previous experience the troops have had in jungle areas. It includes:

(1) Physical conditioning. Physical conditioning is accomplished largely by marches in jungle-type terrain. It also includes some more strenuous physical training to aid in acclimatization of troops.

(2) Field sanitation and hygiene.

(3) Jungle knowledge. Men are taught the rudiments of survival and ground orientation (navigation) in the jungle.

(4) Basic subjects. Basic subjects include scouting, patrolling, trail-cutting, the use of machetes and portable power hand tools, proper camouflage, shelter construction, mines, and boobytraps.

b. Phase 2.--Phase 2 stresses the practical application of jungle tactics and techniques, including techniques of survival and navigation. Emphasis is placed on fire team, squad, and platoon problems (both day and night).

c. Phase 3.--Phase 3 is devoted to unit and combined arms training. It stresses:

(1) Coordination with tank, engineer, and artillery elements.

(2) Company problems over long distances with units operating from 7 to 14 days under jungle conditions.

(3) Movement in the jungle and on the trails with actual resupply and evacuation exercises.

(4) Control and coordination between maneuvering infantry and supporting arms.

(5) Techniques of locating and marking targets and adjustment of fires.

(6) Battalion-size problems with supporting arms and actual logistic play.

(7) Organization of defensive positions, with emphasis on perimeter defense, by battalion and lower units and security measures to prevent infiltration.

5202. RATIONS

Rations for jungle operations are selected to give maximum food value with a minimum of weight. Ration containers and waterproof bags are used to protect food from insects and from contact with humid air. This protection ends as soon as the containers are broken or opened. All wet or damp foods are eaten immediately after opening the containers. Dry foods may be kept for several days if they are placed in waterproof bags and the bags securely closed. Clean food is essential to the health of a command. Basic rules of personal sanitation and hygiene apply.

5203. WATER

Ground water from wells, springs, and infiltration galleries is usually less contaminated, clearer, cooler, and generally more palatable. However, since ground water is limited in quantity, the most common source in the jungles is from surface supplies such as streams, ponds, and lakes. Care is exercised in selecting the water point. Bathing, laundering, and vehicle washing are done downstream.

a. Engineer Water Points.--Whenever possible, all drinking water is procured from engineer water points. Minimum treatment consists of the following steps: sedimentation, filtration, and chlorination to ensure that the finished water contains not less than two parts per million chlorine residual.

b. Emergency and Individual Water Disinfection

(1) Lyster Bag Disinfection.--Suspected matter is strained out through cloth or an improvised sand filter. Two ampules of calcium hypochlorite are dissolved in the 36-gallon lyster bag to ensure a minimum of two parts per million of chlorine residual.

(2) Canteen Disinfection.--Each man is provided with an adequate supply of individual water purification tablets for use on extended patrols or when otherwise isolated from his unit. Generally, adequate disinfection is obtained when one tablet is used for clear water and two tablets for cloudy or turbid water.

c. Other Water Sources.--Water may be obtained during heavy rainfall by catchment from roofs of tents and buildings. This water is treated before consumption. Sea water can be distilled either in standard engineer equipment or in small quantities with an improvised distillation unit. Such facilities are bulky, extremely heavy, and require large amounts of fuel. Their use is justified only when fresh water is otherwise not available.

5204. CLOTHING

Standard clothing is not altogether suitable for jungle operations. Higher elevations generate a requirement for warm clothing at night. In some

cases, freezing can be expected. Ponchos and other rain equipment are essential during the rainy season. Full length trousers and long sleeved shirts protect the skin from insects, scratches, and sunburn. Clothes are washed regularly.

a. Headgear.--The helmet liner is a satisfactory sun shade.

b. Footgear.--Standard footgear is not adequate for jungle wear. In extreme swampy areas, canvas shoes may be required. Shoes and socks wear out quickly.

5205. SHELTERS

Whenever the tactical situation permits, landing force elements construct shelters to protect personnel and keep them dry. Individual shelters are provided or improvised so that troops can sleep off the ground. Hammocks may be issued for this purpose or improvised from blankets, pieces of canvas, or shelter halves. In addition, all personnel are trained to construct temporary shelters from locally available vegetation and materials.

5206. BIVOUACS

The type bivouac area established in the jungle is governed by the tactical situation. In establishing bivouac areas, the perimeter defense is normally used. Bivouac sites are selected on high ground near a source of fresh water to take advantage of better drainage and any existing breeze. The bivouac area is established with an inner and outer perimeter combined with a system of listening posts. Patrols are sent out during daylight hours on all existing trails to determine if the enemy is present or has recently been in the vicinity. During hours of darkness, warning devices are established outside the perimeter at a sufficient distance to provide timely warning of the presence or approach of the enemy. Native villages and immediate surrounding areas are avoided as bivouac sites. The unsanitary condition of most native villages exposes the troops to disease. Further, the less a native can reveal to the enemy the better. It is always assumed that the enemy has populated areas under observation.

5207. NATIVES

Natives of jungle areas can be of assistance to landing force units when properly handled. The more primitive natives respond best to a firm paternalistic treatment. Their loyalty and response is generally to an individual, so it is advantageous that all dealings be through the "head man" by one representative of the military. While natives do respond to ideas and ideals, it is unlikely that they will long remain loyal under pressure. Thus, with proper handling, they can generally be won to "our cause." This is especially true if they know to whom they can go for "redress of wrongs" either real or imagined and have faith in his understanding and judgment. The importance of establishing an "individual" to whom they are responsible and who in turn is the dispenser of all pay, medicine, favors, and rewards, cannot be overstressed. Accordingly, a commander takes early measures to gather information about the natives. Once their friendly attitude is established, he may avail himself of their assistance.

a. Employment of Natives.--Friendly natives may be employed as scouts, guides, carriers, rear area litter bearers, and laborers. Natives are also valuable sources of military information. In some cases, they may form their

own fighting groups. These forces, although limited in military experience, have the advantage of detailed knowledge of the terrain and may be useful for scouting, raiding, and harassing the enemy.

b. Languages.--Native languages vary widely. Local interpretors are usually available. Pidgin English or sign language can be utilized to lessen the language barrier. Natives are seldom experienced fighters and probably are bewildered by the weapons of modern warfare. Reports from natives concerning the size armament, formation, and equipment of the enemy must be carefully evaluated and verified.

c. Dealing with Natives.--Dealings with the natives are through a proper agent. Agreements relative to employment, pay, and rewards are made through the designated agent. This agent is carefully consulted as to native religions, superstitions, and customs. Local rules and customs are respected. Natives are paid a fair price for everything purchased from them. Individuals are not permitted to barter or trade with the natives unless approved by the agent. In dealing with natives, the following actions are taken:

(1) Be friendly, but cautious.

(2) Be courteous.

(3) Respect their customs, religion, and personal property.

(4) Give them gifts.

(5) Do not threaten.

(6) Do not molest their women.

5208. SURVIVAL EXPEDIENTS

Survival expedients in jungle operations require originality and forethought. The following expedients are indicative of the type that may be of assistance:

a. Carry matches in a waterproof container or carry waterproof matches.

b. Carry a light hook and line or a light gig such as a spear with barbed points for fishing. Stunning fish with a stick of explosive is the quickest and surest way of getting a good catch.

c. Remove mud or other solids in water by straining water through a cloth. Stirring a small amount of alum into water causes solids to settle. When water is used for drinking, the water is boiled or otherwise purified.

d. Know how to find water. Small amounts can be found in plants. Sand breaks in a coral reef often indicate fresh water several feet below the surface.

e. Do not attempt to travel at night unless necessary. Halt early enough to make camp. When the tactical situation permits, build a fire and collect plenty of firewood before darkness.

f. To build a fire in wet weather, select a spot that is sheltered from the rain. Find a standing dead tree; then split out the heartwood to start the fire. Start a small fire initially and build it up gradually.

g. Edible fruits can usually be identified by signs of animals having eaten them.

h. All fur bearing animals, birds, and snakes are edible. Ensure that all game is freshly killed and inspect it for diseases prior to preparation.

5209. FIRST AID AND SANITATION

The individual Marine is trained in such first aid measures as control of bleeding, prevention of infection, prevention of shock, application of an arm or leg splint, methods of evacuation, and artificial respiration under field conditions to aid in the saving of life. Disease prevention is a must as many diseases are prevalent in jungle areas. Personal hygiene and military sanitation, to include such items as care of the feet, care of clothing, use of insecticides, insect repellents, and protective clothing and equipment, and disposal of human and other wastes, are of extreme importance in the prevention and/or control of diseases.

5210. HEAT INJURIES

The dangers of heat injuries; i.e., heat exhaustion, heat cramps, and heat stroke, are ever present in the jungle. The effects of heat are minimized by keeping the head and body covered when in the sun; by wearing light, loose-fitting clothes; by taking plenty of salt with food; and by drinking enough water. Detailed instructions for the prevention, diagnosis, and treatment of heat injuries are contained in chapter 4 of this manual.

5211. MACHETE

The machete is one of the most effective items of equipment available to the individual Marine for cutting through the jungle. It is also an effective weapon when silence is imperative.

a. Use.--The machete depends on velocity and angle rather than weight for effectiveness. Maximum velocity is obtained by gripping the machete firmly with the thumb and two fingers and loosely with the last two fingers. The machete is swung with a whip-like motion. Just before the blade strikes the target, the last two fingers of the hand are tightened, giving added strength and velocity to the blade. The blade should meet the target at an angle of 45 degrees for maximum effectiveness. A lesser angle results in a glancing blow dangerous to the user and persons nearby. A greater angle causes the blade to bounce, resulting in a minimum cut. All blows are slanted away from the body to the left or right. Vertical blows are not made with the machete. Before cutting, all personnel and foreign material are cleared from the area. The machete is sheathed when not in use. Trail cutting in the jungle is held to a minimum to avoid detection.

b. Care.--Proper care of the machete provides for:

(1) Sharpening the machete whenever necessary. A grindstone, whetstone, file, or smooth stone may be used. Care is exercised in using

a grindstone to avoid overheating the blade. This can cause the metal to lose its temper.

(2) A heavy oil or grease is used to prevent rust.

(3) The handle is not notched or wrapped as the roughness causes blisters to the hand.

(4) Broken or cracked handles are replaced or repaired to preclude accidents or blisters.

5212. NAVIGATION

Ground orientation and navigation is difficult in the jungle. Successful navigation depends on proficiency in map reading and the use of the compass. Available maps can seldom be relied upon for exact location of trails, roads, villages, and streams. Although maps of jungle areas are fairly accurate, they exclude small hill areas, draws, streams, and other natural objects. For this reason, it is easier to find oneself on the map by direction and distance traveled or by finding a prominent feature on the map and ground and moving to that area. Resection, intersection, and ground orientation are extremely difficult due to the limited distance of visibility. Care is exercised in using existing trails. A thorough map study is made prior to starting on a mission. It is usually safe to assume that trails exist between villages even though not shown on the map. The following procedures aid in navigating through the jungle successfully:

a. Obtain a map that is marked with the current data from all existing sources.

b. Select the following navigational personnel for each column:

(1) Guide.--The guide performs the duties of clearing and marking the trail and aids the leader in maintaining proper direction.

(2) Leader.--The leader maintains direction with the compass, reads and corrects the map, and supervises the actions of the other two members.

(3) Pacer.--The pacer keeps an accurate measure of the distance traveled. Because of the extreme unevenness of the terrain, detours, obstacles, and the doubtful validity in the jungle of maintaining a measured pace, the pacer may have to add one-third of the distance to be covered to arrive at a total distance to travel.

5213. CAMOUFLAGE AND CONCEALMENT

Camouflage in jungle operations is a more personal/individual effort than in temperate or desert climates. Wide use is made of natural concealment by hiding, by blending with backgrounds and shadow patterns, and by screening individuals and emplacements with materials found in the area. There are many opportunities for small scale deceptive practices. Overhead foliage is preserved particularly near bivouacs and landing force installations. Clearings in jungle vegetation draw immediate attention from enemy aircraft.

a. Individual Camouflage/Concealment.--Certain individual protective measures in the jungle are important. The normal close proximity of the

enemy and the concealment available to him make sound, light, and movement revealing to him and constitute a real danger to elements of the landing force. Camouflage discipline becomes immediate and personal; the violator seldom is given a second chance. In jungle operations, scanning of the terrain immediately ahead for selection of a concealed position and a covered avenue of approach is important. Arms and legs are kept covered. Shine from bayonets, belt buckles, and other metal gear is dangerous. The dials of luminous wristwatches can be a giveaway at night.

b. Defensive Positions.--Thick foliage forces the defender into a compact perimeter and thus makes him more vulnerable to mortar and artillery fire; it also increases the hazard of air burst during enemy attacks by fire. Therefore, as soon as fields of fire and foxholes are adequate, trenches are provided overhead protective cover at ground level and are completely concealed by natural camouflage. Communication or crawl trenches leading to alternate positions are camouflaged. Slit trenches are screened and provided overhead cover when feasible.

Section III. TACTICS AND TECHNIQUES

5301. GENERAL

Tactics and techniques employed by the landing force in a jungle environment are related to the conditions existing in the area of operations. Such conditions result from the combined effects of climate, terrain, distances, poor communications, prevalence of disease, and restricted visibility. To facilitate jungle operations and training, pertinent tactics and techniques are incorporated in standing operating procedures. This section discusses jungle tactics and techniques in terms of offensive and defensive combat and in terms of the employment of the available means of combat support. The U.S. Army discusses this subject in detail in FM 31-30, Jungle Operations.

5302. MOVEMENT AND MARCHES

Movement in the jungle is calculated in terms of time rather than distance. In the early stages of a jungle operation, road nets may be limited or nonexistent. Cross-country movement is slow. When the situation permits, existing trails and stream beds are used. The difficulty encountered by supporting arms in displacing in jungle terrain may force infantry elements of the landing force to slow down their rate of advance.

a. Factors Affecting the Rate of March.--The rate of march depends on the type of jungle terrain, the availability of trails, and the formations and security elements employed. March distance, obstacles, and the physical condition of troops are considered in calculating the rate of march. The rate of march, its length, and the number of rest periods are kept in line with the physical endurance of the men. Extreme temperatures make frequent halts necessary.

(1) Animals accompanying landing force elements maintain the same rate of march. However, animals are not kept under pack more than eight hours a day and are allowed sufficient time for care and feeding.

(2) Resupply may be performed by parachute drops, transport helicopters, and in some cases free fall drops, allowing landing force elements to travel lighter and faster than might otherwise be possible.

b. March Discipline.--March discipline is made difficult by problems of control in jungle terrain:

(1) The inability to directly observe the major portion of a march column is partially offset by reduced distances and intervals between individuals and units.

(2) Definite march objectives are assigned. All small unit leaders are completely briefed and indoctrinated on the march plan.

(3) Speed and execution of the march may be facilitated by moving a landing force unit by parallel, but separate columns. Such a formation keeps a unit more compact and better able to deploy for action.

(4) March discipline demands some decentralization of control and aggressive leadership on the part of all small unit commanders. Leaders

constantly check to ensure that the rate of march is maintained and that contact is not lost between units.

(5) Prescribed distances and intervals are maintained.

(6) At halts, while the men relax, constant supervision is required to ensure that security is maintained.

(7) The commander marches well forward in the column where he can control the movement and direct the tactical employment of the unit.

c. Selection of Routes.--The selection of routes is difficult. Unless there is a known obstacle and a known route around it, a straight line is chosen. Commanders look for routes that present a minimum number of obstacles. The march is planned as a series of legs from one objective to the next. It is sometimes necessary to select extremely difficult routes to ensure secrecy and/or surprise.

(1) Maps are used with caution. When selecting march routes, old maps are often inaccurate. However, native trails normally follow the line of least resistance between two points, and if a trail is indicated on a map, there is a good probability that it exists or there is another trail close by. Patrol reconnaissance is the best source of information in selecting routes. All patrols are instructed to note, sketch, and report all variations from existing maps.

(2) Aerial reconnaissance can provide some assistance in route selection. Aerial photographs supplement maps and reconnaissance and are invaluable. In addition, helicopterborne scouting parties may be used to advantage in route reconnaissance.

(3) Trails generally exist between native villages even when none appear on maps. Natives usually blaze or mark such trails, and troops are taught to recognize such signs.

(4) Existing trails and streams are used when the direction of movement and the situation allow it. Streams may be used as trails if they are not too deep or swift. When rafts or small boats are available, a deep stream is one of the fastest and most dependable means of jungle travel.

d. Selection of March Objectives.--March objectives are normally a series of intermediate objectives progressing from one position to the next until the final objective is reached. Terrain features which are easily recognized from the ground and air are good objectives.

(1) March objectives are selected prior to the start of the march and are planned to permit the unit to move from one objective to the next in the prescribed period of time. They assist in navigation and control by providing a series of checkpoints. Objectives may also be used as rallying points in case of ambush.

(2) March objectives selected for halts should lend themselves to the defense and enhance the security of the unit. An area selected for an overnight halt is chosen with particular care and should lend itself to an all-around defense.

e. March Security.--Standard march security measures are applicable to jungle movements. However, distances between contact elements are

reduced and other measures are more intensified because of the reduced visibility and natural obstacles. When a unit is operating independently, all-around security is mandatory.

(1) Point security elements are placed well forward. They scout the area ahead of advancing landing force elements and check out all danger areas prior to the arrival of the main column.

(2) Flank security is a continuing requirement. In dense growth, security elements cut their own trails and experience difficulty in keeping abreast of the march column. They are rotated frequently. The speed of the column is greatly reduced by the frequent rotation of security elements. When flank security elements cannot be used because of restrictions imposed by the terrain, individuals are assigned specific areas of visual surveillance. When crossing danger areas, flank security patrols are employed to cover the crossing. Patrols rejoin their march units as soon as practicable after the crossing is completed.

(3) Supporting weapons are kept well forward while on the march so that when contact is made, the full force of supporting fires can quickly be brought to bear on the enemy.

(4) During extended halts, units move off trails and form a hasty perimeter. Security elements are posted in all directions. At least 50 percent of the unit is placed on the alert. Halts for overnight bivouacs are made with sufficient daylight remaining to adequately secure the bivouac area before darkness.

5303. OFFENSIVE ACTION BY THE LANDING FORCE

Offensive tactics employed by the landing force in a jungle operation are compatible with the tactical principles and procedures delineated in FMFM 6-1, Marine Division; FMFM 6-2, Marine Infantry Regiment; FMFM 6-3, Marine Infantry Battalion; and FMFM 6-4, Marine Rifle Company/Platoon.

a. Movement to Contact.--Dispositions of landing force elements in the movement to contact are determined from the commander's estimate of the probability of contact. These dispositions include the route column, tactical column, and the approach march.

b. Types of Resistance.--The meeting engagement, the attack against outposts or delaying positions, and the attack against an organized position are all conducted in the jungle. Because of the cover-and concealment available, limited observation, and reduced distances that security elements must maintain, the meeting engagement occurs more frequently than in open terrain. In such situations, it is advisable that landing force units have a set plan of reaction. The commander rapidly estimates the situation, arrives at a decision, issues necessary orders, and executes his plan of attack with all possible speed. Aggressive action in the meeting engagement often allows a smaller force to defeat a larger force.

c. Forms of Maneuver.--The principal forms of maneuver are the frontal attack, the penetration, and the envelopment.

(1) Frontal attacks are generally more costly and often merely force the enemy back on his line of communication. When employed, the main

effort is directed at cutting the enemy off from his natural routes of withdrawal.

(2) The value of the envelopment is enhanced in jungle operations because of the dependence of the defender on routes of supply to his rear.

(3) Movement through the jungle is time-consuming, and it may take hours for the enveloping force to reach its attack positions. This is considered in planning.

(4) Helicopterborne forces may be used to outflank enemy defenses or to seize critical objectives in advance of attacking troops. Consideration is given to the preparation or selection of adequate landing sites.

(5) Regardless of the type or form of attack employed, a detailed plan for an attack is required. Ground reconnaissance is accomplished to the extent feasible. Ground reconnaissance may not always determine the development of the enemy position, but it can usually determine the extent.

d. Scheme of Maneuver.--The scheme of maneuver in a jungle operation is based upon the following considerations:

(1) Selection of Objectives .--Objectives selected best contribute to the execution of the overall scheme of maneuver when they are easy to identify on the ground, permit a convergence of effort, facilitate future operations, and their capture ensures the destruction of the enemy or forces his withdrawal.

(a) An objective may be a body of troops, a communication center, a key terrain feature, or a vital area to the enemy's rear.

(b) The very nature of jungle terrain with its limited lines of communication makes trails, trail junctions, and stream crossings vital to both the attacker and defender. They may become prime objectives in jungle operations.

(c) Often, when attacking through the jungle, there are no easily identifiable objectives. In this case, the objective may be designated as a line so many yards in a given direction.

(d) Objectives are also classified according to type; i.e., deep, intermediate, or close. In jungle operations, all three types of objectives may be found. Because of the topography, poor observation, impeded communications, and difficult movement, close objectives are more often utilized.

(e) By assigning numerous and well-defined close objectives, the commander affords himself an excellent means of coordinating the efforts of his subordinate units.

(f) As each objective is taken, the commander can order the attack continued or hold his unit until adjacent units are in position or within supporting distance.

(2) Main Attack.--The planning of the main attack in a jungle operation does not differ from similar planning for other operations. Frontages assigned are narrower to ensure maximum concentration of fires and maintenance of control. The main attack is planned to secure the decisive objective of the unit. Its direction is influenced by terrain available, maneuver room, means of mobility available, and the enemy situation.

(3) Supporting Attack.--As the commander develops his plan for the main attack, he visualizes the task to be accomplished by the units making the supporting attack. This includes objectives, direction of attack, and required maneuver room so the supporting attack may best assist the main attack.

(4) Reserve.--Determination of the size and location of the reserve is normal. The commander employs only those units essential to accomplish the task of the main and supporting attacks. The remainder is retained in reserve to be employed at the decisive moment to ensure seizure of the objective, to exploit success, or to maintain the momentum of the attack. The topography of the jungle dictates that the reserve follow the attacking force closely so that it may be rapidly committed at the critical time or carry out mopping-up operations without delay. Planning for the use of the reserve is continuing and is modified to meet changes in the situation ashore as they develop.

(5) Formations.--In determining formations for landing force units in the attack, primary consideration is given to the mission to be accomplished. Other considerations include enemy disposition and capabilities, weather and terrain, size of assigned zone, fire support available, location of friendly units, security, ease of control, and speed of movement.

(a) It is more difficult to maintain control and direction when operating in the jungle. Formations are of necessity more compact. They are often similar to those employed in night operations.

(b) Units may maintain column formations after crossing the line of departure, almost to the point of assaulting and overrunning the enemy position. At the same time, it is essential that maximum fire and shock power are developed prior to the assault.

(6) Control.--Once the attack commences, control is largely decentralized. To a large degree, execution of the attack depends on the individual initiative and leadership of small-unit commanders.

(a) As a result, small-unit combat in the jungle is the rule instead of the exception. Lower levels require a thorough understanding of their assigned missions.

(b) The ability of the overall commander to change his plan once it is placed into operation is extremely limited, but he must provide all possible means for control and coordination in his plans.

(c) The commander provides for this control and coordination of the attack in jungle operations by employing the same tactical control measures that are used in conventional terrain.

e. Fire Support Plan.--Fire support is as essential in the jungle as in open terrain. Unsupported infantry cannot overcome defensive positions without heavy casualties. The fire support plan is developed concurrently with the scheme of maneuver. The principles for planning supporting fires delineated in FMFM 7-1, Fire Support Coordination, are valid. However, the jungle makes the job more difficult. The area or position on which the fires are delivered is hard to pinpoint in the jungle, and registration is difficult. The dense growth makes firing positions difficult to find or establish. The jungle terrain restricts the employment of fire support means and puts a premium on imaginative employment.

f. Night Attacks.--Night attacks in the jungle are rare, but they can be executed successfully. Some of the more important considerations in planning such an attack are:

(1) Virtually all movement toward the attack must be made over existing trails. Cutting new trails slows the attack and may disclose its nature to the enemy.

(2) Coordinating the time of attack is difficult. Landmarks are scarce or nonexistent. Pyrotechnic signals may not be seen by all subordinates due to the dense overhead growth.

(3) While all jungle attacks are concerned with close objectives, objectives are even closer in the night attack.

(4) Time is required for subordinates to effect daylight reconnaissance and, if possible, night reconnaissance.

(5) The possible surprise effect of a night attack frequently makes such operations decisive.

(6) The normal difficulties of movement and control are so complicated by darkness that large-scale, coordinated, night offensive operations are usually impossible.

5304. DEFENSIVE ACTION BY THE LANDING FORCE

Defensive tactics employed by landing force units in the jungle do not differ in principle from defensive combat in other terrain. The following principles are applied:

a. Proper Utilization of Terrain.--Organization of the defense in the jungle takes maximum advantage of the military aspects of the terrain. The defense is designed to force the enemy to attack organized positions or to make a time-consuming maneuver to avoid them.

(1) Routes of communication constitute the key terrain. The defense is oriented to hold those routes of communication vital to the landing force and, at the same time, deny them to the attacker. Defensive positions on routes of communication are established at locations which cannot be easily bypassed by the enemy.

(2) When the defender possesses superior firepower in the form of direct fire weapons, fields of fire are of primary consideration in organizing the terrain. When he has inferior firepower, the protective concealment of the jungle growth becomes more important.

b. Security.--Security is planned to gain early information on the enemy approach. Patrols, sentinels, OP's, and listening posts are all extensively used. Listening posts are established at the limit of the sound range from the camp, perimeter, or FEBA. The severeity of jungle terrain normally forces security elements to work at reduced distances.

(1) Outposts are organized in sufficient strength to delay and disorganize the enemy and prevent his attacking before the FEBA can be alerted.

(2) The jungle offers so much cover and concealment that infiltration is always a problem. Tripwires, flares, rattles, and antipersonnel mines are installed around defensive positions to give warning of the enemy's approach at night.

(3) Illumination of the battlefield is effected by standard methods in case of an enemy night attack.

(4) The best method to prevent surprise is to constantly know where the enemy is and what he is doing. This requires an integrated effort of all information-gathering agencies. Aggressive ground patrolling combined with imaginative use of helicopters and other air agencies can produce many answers. Night patrols in heavy jungle are rarely productive.

c. Mutual Support.--Mutual support is extremely difficult to provide because of limited observation and poor fields of fire. It may be necessary to employ a continuous line along the FEBA with no gaps to ensure mutual support. As a result, more troops are required on the FEBA, and the frontage assigned a given unit to defend is narrower than that assigned in normal terrain.

d. Defense in Depth.--Defense in depth is difficult to achieve. Reserves may occupy positions close behind the frontlines. When practicable, additional troops may be employed to give depth to the defensive effort.

e. All-Round Defense.--An all-round defense is necessary in jungle terrain because of heavy vegetation affording concealment and the many avenues of approach.

f. Coordinated Barrier Planning.--Coordinated barrier planning is as important in jungle operations as in any other operation. When possible, both flanks of a unit are anchored to an obstacle such as a river, swamp, or cliff. Obstacles to the front are used extensively. When feasible, natural obstacles are augmented by artificial ones. The mining of roads and trails is of prime importance in this respect because of the jungle's canalizing effect. Hasty abattis can often be made by tanks or LVT's pushing over shallow-rooted trees. The paths of the tanks or LVT's must be reconnoitered thoroughly beforehand by tracked vehicle personnel to reduce the chance of their getting "hung up" in this process.

g. Coordinated Fire Planning.--The fire support plan provides for the coordination of weapons supporting the unit concerned. The effectiveness of any fire plan in the jungle is reduced by the lack of observation and short fields of fire. Long-range fires, close defensive fire, and fires within the position are planned and executed as in normal terrain.

(1) Decreased frontages, shorter distances, and closer intervals between units in jungle operations call for extensive and detailed planning of final protective fires. Primacord may be used for last-moment, rapid clearing of fire lanes for automatic weapons.

(2) The control of fires of the infantry's organic weapons is decentralized to the extent required by the frontage of the unit, the terrain, and the limits of the higher commander's observation.

(3) Units whose defense areas are not under attack or whose fires are not required to support the area under attack hold their fires so that their positions will not be disclosed.

(4) The effects of jungle terrain on the supporting weapons are always considered when planning for fire support.

h. Flexibility.--A landing force element achieves flexibility in the defense by withholding an adequate reserve to be employed in blocking or counterattacking and by centralized control of supporting fires.

(1) Because of jungle conditions, observation and fields of fire are poor, and the positions from which the reserves can support the frontline units by fire are extremely rare. Blocking positions to limit a penetration are more difficult to utilize because of the restrictions on maneuver.

(2) Reserves are normally used in counterattack roles. They require carefully prepared routes of approach for counterattacking penetrations. Such preparation often requires extensive engineer support.

i. Maximum Use of Offensive Action.--An offensive state of mind and an aggressive spirit are maintained. Landing force units are trained to shift rapidly from the defense to the offense. Constant pressure is maintained against the enemy. Aggressive and extensive patrolling can help maintain this offensive state of mind. Ambushes provide an economical means of inflicting casualties on the enemy.

j. Separation.--As with defensive operations in any terrain, the requirement for separation consistent with the unit mission is practiced. The commander weighs the estimated nuclear threat against his own danger of defeat in detail in preparing his defense plans.

5305. COUNTERGUERRILLA OPERATIONS

Jungle operations normally involve extensive actions against guerrilla elements. Counterguerrilla operations conducted in the jungle environment are executed in accordance with the general tactical principles delineated in FMFM 6-3, Marine Infantry Battalion, and FMFM 6-4, Marine Rifle Company/Platoon. Training of landing force units for counterguerrilla actions in a jungle emphasizes patrolling, ambush and counterambush actions, and the fire flush and rabbit hunt techniques.

a. Patrolling.--Extensive and aggressive patrol action provides an effective intelligence gathering agency to a commander conducting counterguerrilla operations. In addition, patrols moving in an apparently random, but thoroughly planned manner, throughout the area of jungle operations, force guerrillas to keep moving. Continuous patrolling over a

prolonged period of time results in clashes with guerrillas since saturation type operations make it extremely difficult for guerrillas to operate effectively. If the guerrilla is kept running, fighting, and hiding long enough, attrition from casualties, desertions, and the loss of contact with the civil population can cause the guerrilla band to break up to a point where they can be effectively controlled by indigenous forces. On the other hand, constant pressure by the multitude of small patrols can have the opposite effect and force guerrillas into a comparatively compact group where large forces can be brought to bear.

(1) Security.--Extensive patrol activity requires some form of security to prevent clashes between friendly elements under conditions of poor visibility. Such a requirement accelerates the need for boundaries between patrol areas of responsibility or carefully designated patrol routes, and the patrol leader must know the extent of these boundaries, both on the ground and on the map. (See fig. 37.) In most cases, the coordination of patrols is planned in advance. This coordination is especially critical in swamps and jungles where patrol contacts are inevitably at close quarters and demand immediate patrol member reaction. One of the primary problems in executing patrol plans is that of introducing the patrol into the operational area without jeopardizing probable success of the mission. It is always assumed that all civilians are hostile and that any contact with them is relayed immediately to the guerrilla camp. Means to be employed in avoiding civilian observation include:

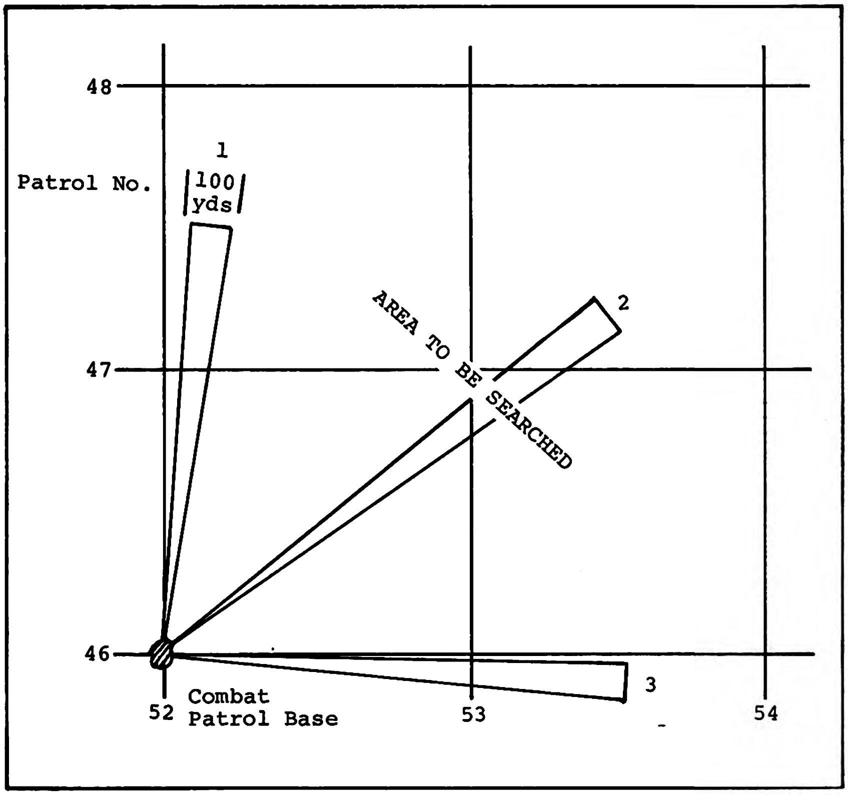


Figure 37.--Use of Azimuths to Coordinate Patrols.

(a) Movement of the patrol by night.

(b) Movement of the patrol by civilian transport (transport secured by civil police).

(c) The use of indirect routes into the area to be patrolled.

(d) Introduction of patrols into inaccessible, remote areas by use of helicopters and rope ladders, as well as by parachute. Troops must rehearse such procedures.

(2) Formations.--Patrol formations are designed to produce maximum firepower immediately on contact. They should also make it easy for all troops to take immediate ambush or counterambush action.

(3) Types of Patrols.--Patrols are divided into two primary types: reconnaissance patrols and combat patrols.

(a) Reconnaissance Patrols.--Reconnaissance patrols are generally composed of small elements. They avoid all contact and move by stealth in pursuit of their mission. They can be sent out from the base area, or they may be dispatched from a combat patrol base. Reconnaissance patrols are normally given only one mission. However, on being debriefed following return to base area, they report all information they have gathered.

(b) Combat Patrols.--Combat patrols may vary in size from a squad to a reinforced company. They generally seek out and attempt to destroy the guerrilla. Missions for combat patrols include:

1 Attack of guerrilla camps or areas known to be supporting guerrillas.

2 Pursuit of guerrillas after contact has been made.

3 Execution of an ambush.

4 Domination of an area to deny guerrilla contact with the populace.

5 Search of remote areas.

(4) Evacuation.--In patrolling areas such as swamps and jungles, aid to or evacuation of casualties is an important consideration. Plans provide for a preselection of drop and/or landing zones. It is advisable to have prepared bundles of saws and explosives which can be dropped or lowered to a patrol in order to cut a landing area. Such details are not so critical in more open terrain.

(5) Special Equipment.--Patrols, especially in jungle areas, may last for several days. It is essential that only necessary items of clothing and equipment be carried. Too often personnel are overloaded with unnecessary gear. Consideration is given to the assorted special types of equipment available, including such items as infrared equipment and radar devices. The limited visibility in jungle operations dictates that personnel be armed with a preponderance of automatic weapons and some shotguns.

Fragmentation grenades are reasonably light and are used extensively in the jungles. Adequate radio equipment is essential, and a periodic radio contact time is specified so that patrols may report in.

b. Ambush.--An ambush is a surprise attack upon a moving or temporarily halted guerrilla element. Its object is to capture or destroy the guerrilla force. Best results are obtained by ambush patrols employed in remote areas where the guerrilla would not normally expect to find landing force units. Ambush missions are dependent on detailed knowledge of the enemy.

(1) Equipment.--Equipment carried by ambush forces varies with each mission. More special equipment is needed to ambush a mounted guerrilla force than a foot element. Since success of the ambush depends largely upon surprise and shock action, a preponderance of automatic weapons is needed to deliver an annihilating volume of fire. Vehicular targets require mines, rifle grenades, rocket launchers, and demolitions in addition to automatic weapons. When the ambush force and the site to be prepared are large, wire is required for control purposes.

(2) Planning Considerations.--Important considerations in the successful execution of an ambush against guerrilla forces include:

(a) Concealment.--Success is based on surprise. Surprise without astute concealment is difficult to achieve.

(b) Patience.--Ambush parties may have to wait for days before a target arrives.

(c) Rehearsal.--To ensure fully coordinated action of ambush parties, rehearsals are conducted and every possible counterambush action of the enemy is considered.

(d) Knowledge of the Guerrilla.--An ambush party having a specific mission requires detailed information as to the habits and tactical patterns employed by the guerrilla forces. A general ambush mission is not given to uninitiated or inexperienced troops. Such a mission is given only after troops have become familiar with the terrain and with the tactics and habits of the guerrilla force.

(e) Cover.--Adequate cover at the ambush site and covered routes of withdrawal to a predesignated rendezvous area or rally point are essential.

(3) Organization.--Normally, an ambush party is organized into an assault and a security element.

(a) Security Element.--The security element has the mission of protecting the assault element and of sealing off avenues of approach into the ambush site which may be used by the guerrilla force to relieve its attacked elements. The security element also covers the withdrawal of the assault element from the site. It does not normally participate in the attack unless the guerrilla force is escaping.

(b) Assault Element.--The assault element captures or destroys the guerrilla force. The ambush party leader determines when fire commences. In the jungle, this is usually on sight, whereas in more open

terrain, it is on a prearranged signal or at a time when the enemy arrives at a predesignated point. Accurate, rapid opening fire is essential for success. Predesignated individuals make a hasty search of the target area after the ambush action. On completion of the search or on a given signal, the ambush party withdraws to a rally point. Often in jungle terrain, some of the guerrillas escape the initial burst of fire and attempt to flee. Blocking parties are immediately dispatched to block routes of escape. Designated pursuit parties take up the chase. Tracking dogs and native guides can be of value in a pursuit action. Successful pursuit operations are rare, but the opportunity for a capture or kill is exploited.

(c) Support Element.--If crew-served weapons are being used in the ambush, a separate organization is often desirable to make maximum use of available firepower. The assault element's firepower complements the support element fires until the assault element's killer teams sweep the objective.

(4) Site Preparation.--When the selected ambush site does not have natural obstacles on at least one side, it is necessary to create them. This may be done by using demolitions, wire, antipersonnel mines, and antitank mines or improvised man traps. The guerrilla force is allowed no avenue of escape once he is trapped in the kill zone. In a vehicular ambush, initial fire should destroy the lead and trail vehicles. Sectors of fire are designated to ensure that the entire guerrilla column/element is covered.

c. Counterambush Action.--Counterambush techniques, consisting primarily of immediate action drills, are necessary considerations in counterguerrilla operations. All landing force elements are trained in their execution. A landing force element caught in ambush is at a tremendous disadvantage. To avoid annihilation, it must react immediately and violently. Two general techniques which may be employed in countering ambushes of either foot or motor-mounted units are:

(1) The element receiving the initial burst of fire takes cover, then reacts immediately by returning a maximum volume of fire. Individuals seek cover immediately and attempt to build up fire superiority, while the elements which have escaped the initial burst maneuver against the enemy position without further orders. Variations of this technique are depicted in figures 38 and 39.

(2) On receiving the initial burst of fire, the ambushed party returns fire and immediately assaults the enemy position. This action may confuse the enemy and cause him to break the ambush thus enabling the landing force elements to close rapidly. Such action may hinder the enemy's withdrawal and "fix him" for a period of time, thus possibly enabling other friendly forces to join the action. This technique is primarily applicable to combat patrols. It requires extensive training. However, small reconnaissance elements of four to six men should not attempt the above illustrated technique. Rather, these very small units should attempt by reverse leapfrog to break contact and disappear into the jungle. The reverse leapfrog is a withdrawal by fire and maneuver.

d. Fire Flush Technique.--The fire flush technique may be employed by landing force units against guerrilla elements in the jungle. This technique uses artillery, air, and/or naval gunfire to flush guerrillas from an area in dense jungle or swampy terrain. (See fig. 40.)

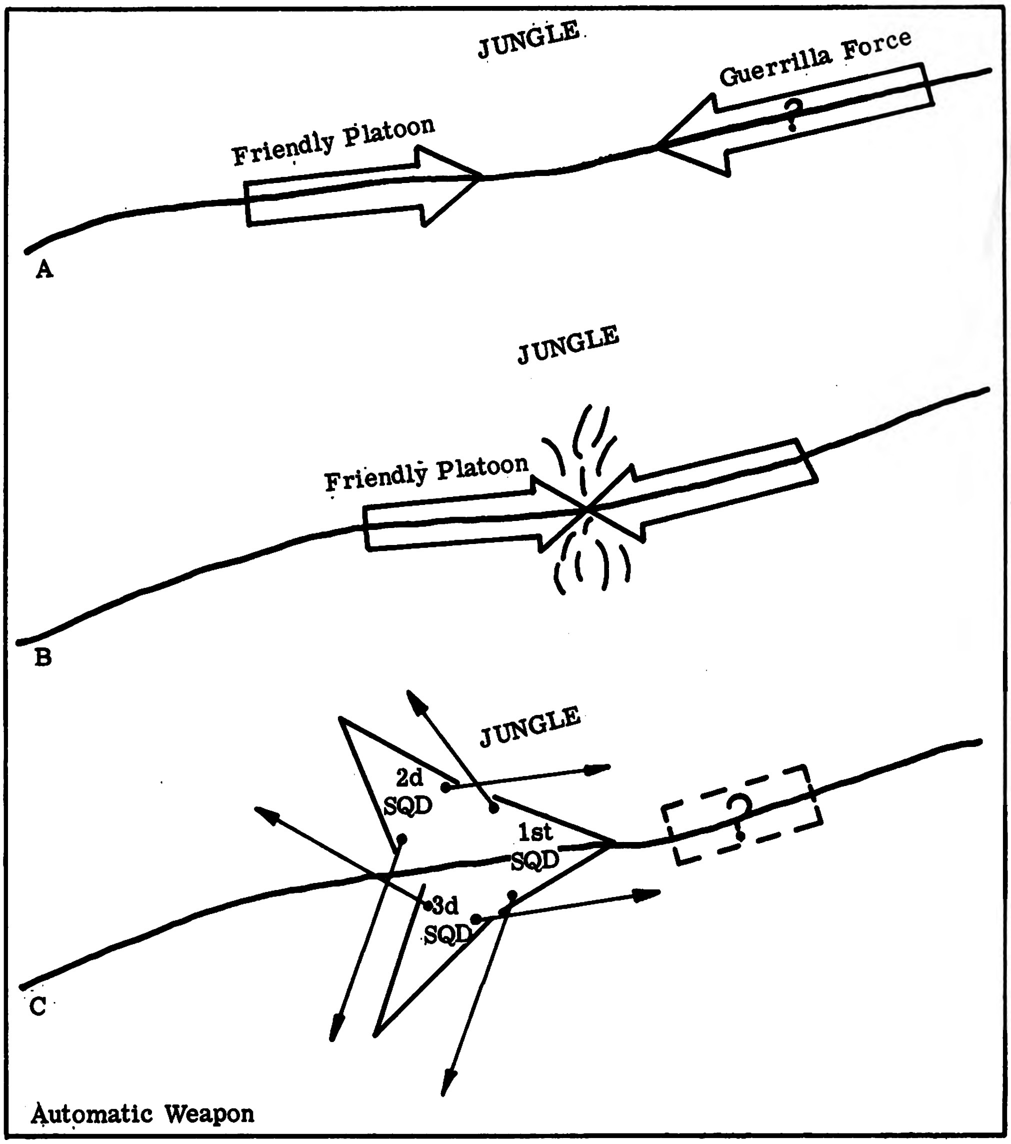
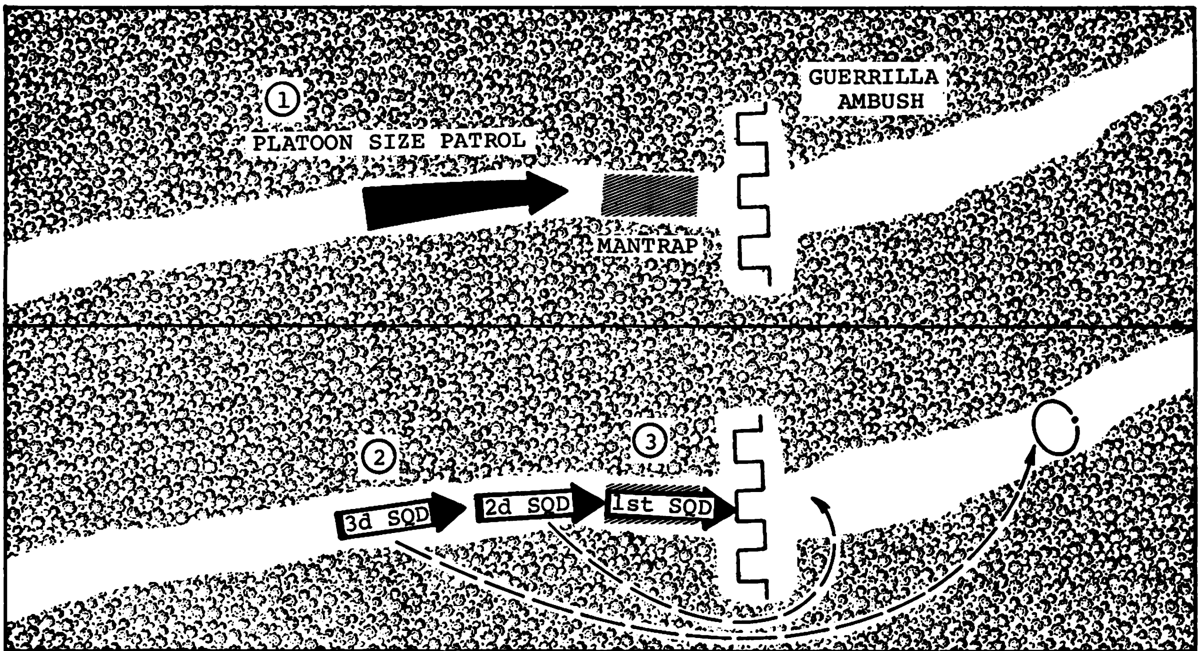


Figure 38.--Immediate Counterambush Action.

(1) Employment.--The area of operations is divided into squares. It is desirable to use an area whose size coincides with a 1:50,000 grid square. Within this area, saturation type bombardment is employed to keep the guerrilla on the move and inflict casualties. Landing force elements occupy ambush positions surrounding the area to be bombarded simultaneously with the initiation of the bombardment or as close thereto as possible. The guerrilla taking flight from the barrages is swept into the waiting ambushes. Areas to be hit are picked at random without regard for routine or regularity. Short delay fuzes are employed which allow for the projectiles to penetrate the jungle canopy prior to detonation so as to achieve maximum effect at ground level.



(1) A patrol advancing through the jungle encounters an ambush.

(2) On coming under fire, the lead elements of the patrol immediately return fire and attempt to develop a fire superiority. The second squad moves around the right flank and attacks the guerrillas' flank; the third squad envelops the deep right flank and establishes a blocking position further down the trail. This squad (the third) will ambush guerrillas who attempt to escape. This block must be given time to get into position prior to launching the second squad flank attack.

(3) The "mantrap" is a shallow trench on the bottom of which are placed sharp spikes of metal or bamboo. It is designed to impale ambushed party members who in their haste to get under cover fall into the pit. The mantrap is usually covered with a light cross-woven camouflage cover of leaves.

Figure 39.--Counterambush Techniques.

(2) Coordination.--The designation of areas to be bombarded and fire plans are closely coordinated. Landing force elements are placed as close around the area as possible. When larger numbers of troops and fire support means are available, it may be possible to bring larger areas under attack.

e. Rabbit Hunt Technique.--The rabbit hunt technique may be employed in the jungle when a small size guerrilla force is located and where, due to the inaccessibility of the area, an encirclement is impossible. Generally, the only course open to the guerrilla is to escape by exfiltration.

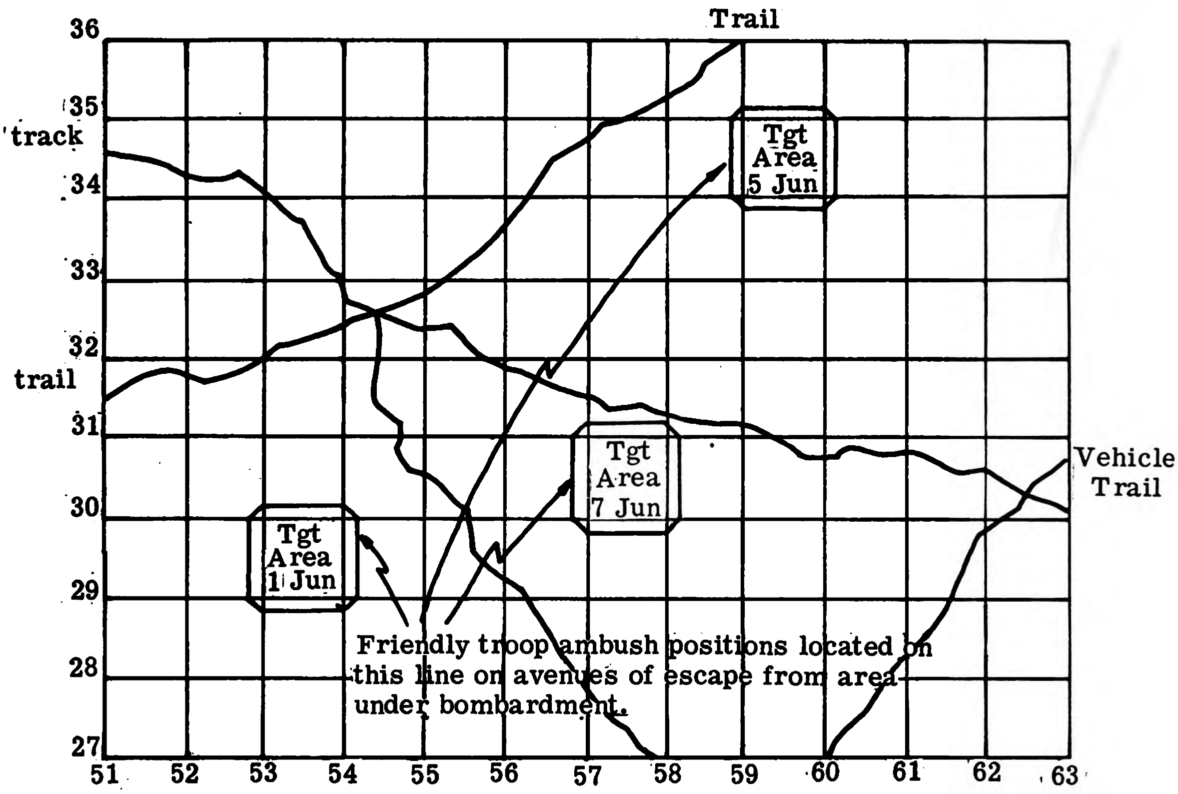


Figure 40.--Fire Flush Techniques.

(1) Employment.--The rabbit hunt technique uses a preplanned series of outposts sufficiently strong to eliminate guerrillas attempting to escape. A hunting element is employed to drive the guerrillas into the ambush forces. (See fig. 41.) Both the hunting and ambush elements are backed up by reserve forces to block any attempt by the enemy to conduct an organized breakout.

(2) Hunter Element.--Success in this operation is achieved only as a result of a scrutinizing search of the area. This requires that personnel in the hunting line be in close lateral proximity to ensure complete area coverage.

(3) Weapons.--Terrain and ground cover in the search area dictate the type weapons to be employed by the "hunters" and the ambush forces. Light automatic weapons are recommended for hunters because of their proximity to the enemy. Heavier automatic weapons are appropriate for ambush or outpost sites. Both forces should include expert riflemen armed with sniper's rifles.

(4) Fire Control.--To ensure that friendly troops do not fire on one another, personnel in ambush sites are kept informed of the progress of the line of hunters by radio. This consideration is less urgent in open areas. The speed with which the hunter line moves is determined by the ability of the troops to maneuver in the area being searched.

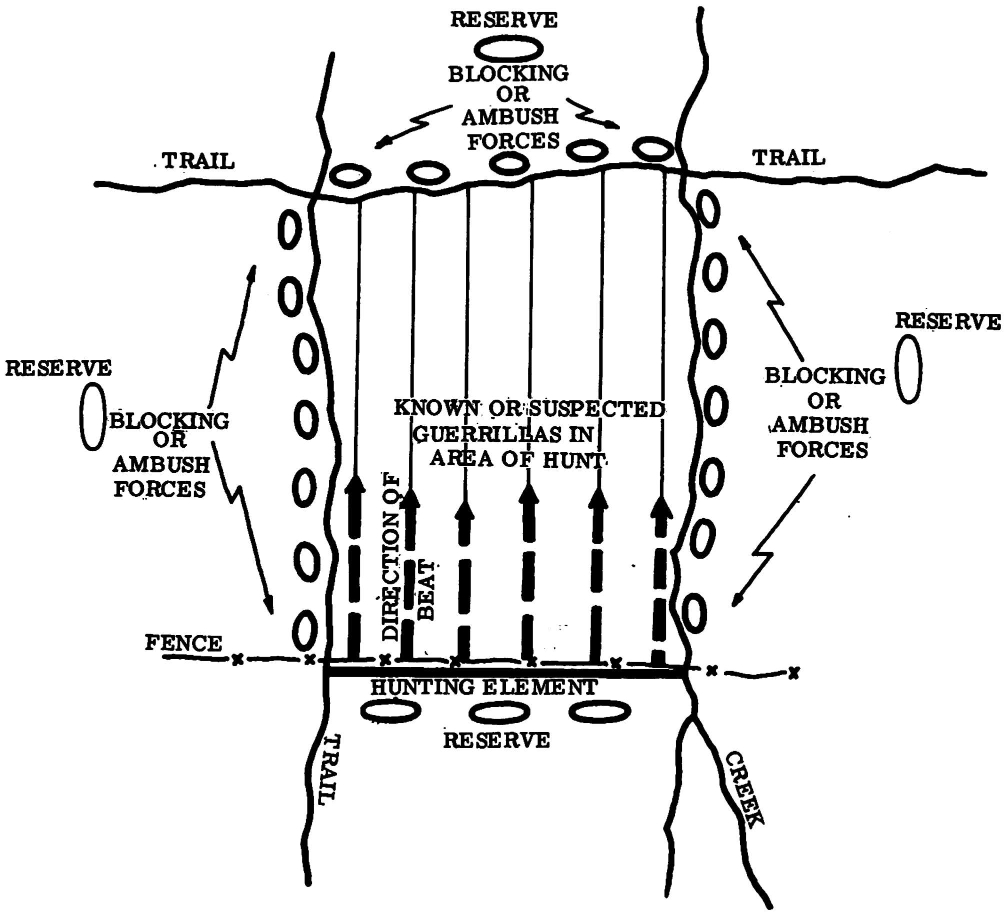


Figure 41.--Rabbit Hunt Technique.

f. Helicopter Techniques

(1) Sparrow Hawk.--This technique uses two combat units and one helicopter unit; one combat unit conducts saturation patrolling of a target area, and a second stands by as a helicopterborne reaction force on "strip" alert. When a patrol encounters an enemy force, the "sparrow hawk" is launched to reinforce the contact unit or to set up a blocking position upon which the contact unit can drive the uncovered enemy.

(2) Eagle Flight.--This technique uses an airborne combat force and a two-unit helicopter force. The combat unit and one helicopter unit (transports) loiter airborne. The second helicopter unit (composed of light observation and armed helicopters) "jitterbugs" (constant change of attitude) at low level from one suspect area to another. This second unit makes use of electronic airborne personnel and equipment sensors in order to locate enemy targets. If a target is located, maximum use is first made of supporting arms, then the airborne combat unit is landed to attack the enemy, form a blocking position upon which supporting arms can drive the enemy, or act as a fixing force which contains the enemy until combat reinforcements can be landed to increase the size of the attack force to a superior

level. These subsequent landings are the "pile-on" technique and troops are landed continuously until the force is of an appropriate size to defeat the enemy.

5306. EMPLOYMENT OF INFANTRY WEAPONS

To obtain the full value of concentrated firepower from organic weapons, infantry commanders determine how and to what extent they can overcome the limitations imposed by the jungle on the mobility, visibility, and control of the infantry's organic supporting weapons. In addition, rigid fire control and fire discipline practices are required.

a. Machineguns.--Firing positions with good fields of fire are limited. Positions from which machineguns can support the company as a whole are rarely found. It is more advantageous to employ them in support of rifle platoons. Due to the terrain, it may be necessary to employ the machineguns singly instead of by sections. Fields of fire in the defense are improved by cutting the lower vegetation and leaving an overhead.

b. Flame Weapons and Rocket Launchers.--The accuracy, mobility, and striking power of flame weapons, the light assault antitank weapon (LAAW), and the rocket launcher make them invaluable as supporting weapons for jungle operations. They are exceptionally useful in reducing bunkers. Care is taken in the selection of positions.

c. 106mm Recoilless Rifles.--The accuracy, mobility, and striking power of the 106mm recoilless rifles make them valuable as supporting weapons in jungle operations. They are suitable for the reduction of enemy installations and may be more effective than indirect fire weapons on these targets.

(1) Firing positions are selected with due consideration for the location of friendly troops, routes of resupply for ammunition, and the prevention of disclosure due to the backblast. Alternate positions are carefully selected.

(2) Due to the backblast, the weapon has to be moved frequently to prevent its being located and destroyed by enemy action. In the very dense jungle, it can most effectively be employed with frontline troops in a supporting role.

(3) When the terrain is such that the enemy can employ tanks, the 106mm recoilless rifle is used in its primary role as an antitank weapon.

d. Mortars.--Emphasis is placed on the employment of mortars in the jungle. Commanders anticipate displacements well in advance and plan positions as far forward as possible. The time factor for the preparation of emplacement, entry roads, and mask clearance is greatly increased, requiring as much as 4 to 24 hours.

(1) The selection of good firing positions is difficult. Positions are compact and are usually cut out of the jungle. Advance parties are increased and supplied with additional power saws, demolitions, axes, machetes, and other engineer tools.

(2) Cutting of mask clearance is kept to a minimum. Branches of fallen trees are used as camouflage to replace the cut canopy, and fresh cut stumps are covered.

(3) The thick undergrowth forces the survey team to tape short legs. This results in less accuracy.

(4) Limitations imposed on observation and visibility generate a requirement for an increased number of observers. All troop leaders require a working knowledge of observed fire procedures and methods for communicating fire requests.

(5) Observers operate well forward and receive extensive training in adjusting fire by sound sensing using the creeping methods of adjustment. Observed fire on the ground is extremely difficult or impractical due to the vegetation which limits observation and visibility to short distances.

e. Mines and Boobytraps.--The jungle lends itself to the use of mines and boobytraps. The characteristics of the jungle cause their emplacement to be comparatively easy and detection extremely difficult. Mines and boobytraps can be used to advantage along trails, roads, ridge lines, streams, and in conjunction with other defensive measures. Recording and reporting are extremely important and are accomplished as outlined in appropriate publications. For further details, see FM 20-32, Mine Warfare.

5307. EMPLOYMENT OF ARTILLERY

The employment of artillery in the jungle environment is compatible with the tactical principles and procedures delineated in FMFM 7-4, Field Artillery Support. Such procedures are modified as necessary to cope with extremes of the environment.

a. Positions.--Jungle vegetation makes the occupation of positions difficult. Artillery batteries usually occupy positions near roads or trails. Fields of fire are hacked out of the jungle. Supporting engineers with power equipment are often required. Positions provide for a 6,400-mil, all-round fire capability. In some cases, positions found along streams or on adjacent islands may provide better fields of fire.

(1) Landing force artillery units stress position security. Positions are more concentrated than in normal terrain. Normally, a tight perimeter defense is established. The area is bounded by barbed wire set out beyond hand grenade range and supplemented with boobytraps, trip flares, and sharpened stakes. (See fig. 42.)

(2) Within the position, paths or trenches are cut to connect each howitzer section with other battery installations and with foxholes which can be occupied to support the perimeter defense. Lanes of fire for machineguns are cut in the form of tunnels through the jungle and interlock with those of adjacent machineguns. Wire entanglements are placed around each howitzer section to prevent close-in grenade and bayonet charges. All personnel have foxholes readily available. At least two men are alert at each howitzer at all times.

(3) A reaction force is designated and training conducted to ensure that, when required, effective reaction to any enemy threat will be conducted.

b. Movement.--Jungle areas restrict the mobility of artillery units. Much of the ground is marshy. The few roads or trails available often become muddy quagmires when used by heavy vehicles. Turnaround areas are practically nonexistent. Pieces may have to be manhandled into position.

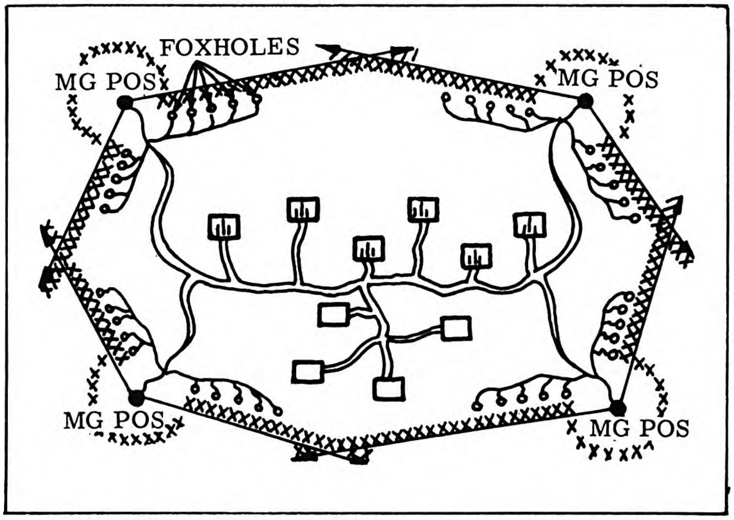


Figure 42.--Typical Artillery Defensive Position.

Tractors and bulldozers are often required and winches on vehicles are advisable. Vehicle maintenance requirements increase because of spring failures, the overheating of engines, the failure of electrical and fuel systems, and the corrosive effect of the humidity on exposed metal and canvas. Utilization of waterways may enhance the mobility of artillery. In addition, the use of helicopters for lifting artillery is often feasible and provides batteries with a capability to move from one firing position to another, bypassing impenetrable areas.

c. Target Acquisition.--Observation is severely restricted in the jungle. Since it is difficult to establish exact locations, forward observers carry control forward by compass and pacing, if necessary, and coordinate with observation aircraft or helicopters. Aerial OP's are valuable in acquiring targets but are hampered by the tree canopy. They are most useful in observing cleared areas and locating enemy bivouac sites and artillery and mortar positions. The employment of target acquisition systems is limited since the use of sound and radar equipment is restricted. When they can be installed, the sound ranging bases and the counterbattery or countermortar radars can operate efficiently though their effective range may be reduced. Ground surveillance radars and flash ranging bases are almost useless. When it is possible to use sound and radar, installation of the equipment with appropriate wire nets may be accomplished by helicopter.

d. Delivery of Fire.--The delivery of accurate massed artillery fires is difficult. Unobserved or predicted fire is often used. The excessive masks caused by tall tree lines force the extensive use of high angle fire. Because heavy growth limits the effective burst radius of artillery shells, an observer may bring his rounds in closer to landing force elements. However, caution is exercised in adjusting low angle fire to ensure that rounds do not burst in the trees above friendly troops.

(1) FO's may adjust on unseen enemy targets by sound, "creeping in" their rounds for close-in targets. These sound adjustments can be refined by using a combined adjustment with two observers. Location of landing force frontlines is a constant problem since assault elements have

trouble in reporting their locations accurately and are often only a few meters from enemy troops. Such situations demand very accurate initial data and careful adjustment.

(2) High explosive shells are effective in the jungle, though the choice of fuze is influenced by the nature of the vegetation cover. (See fig. 43.) Fuze quick is effective in low tree canopy or grassland, often giving tree bursts at a desirable height with the bonus effect of splintering. VT and time fuzes are difficult to sense in adjustment and lose some of their fragmentation effect in tree canopy. VT may prove erratic because of the excessive moisture. Fuze delay, activated by the trees, usually gives a burst on or near the ground and is used in greater proportions than usual. White phosphorous (WP) shell is valuable because its burst can be easily identified, and WP or base ejection rounds are useful in marking for airstrikes. Care is used in the storage of ammunition since exposed powder charges and metal surfaces deteriorate rapidly in the jungle humidity.

e. Survey.--Since adequate maps do not exist for most areas in jungles, the establishment of survey control is an important consideration. Though survey through jungle growth is time-consuming, survey control is usually feasible because the advance of the infantry is hindered by the

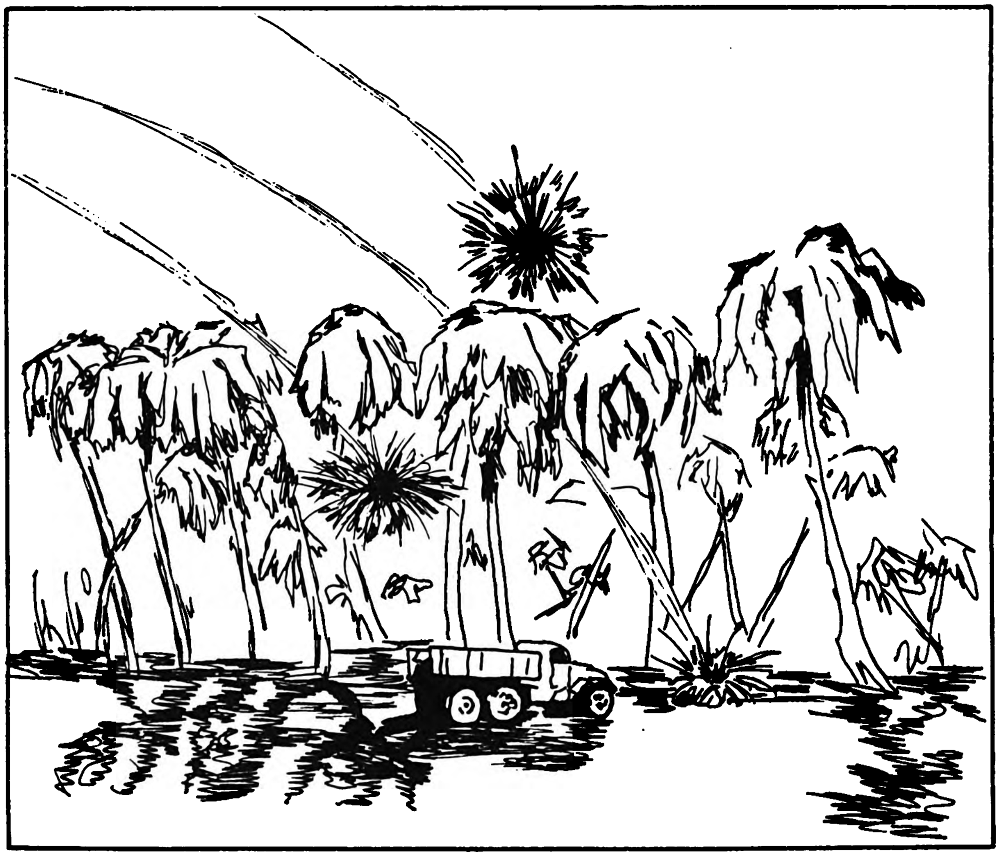


Figure 43.--Fuze Action in the Jungle.

terrain. Control is carried up to OP's when feasible but target area survey may be impossible. Common direction can be obtained by astronomic observations or with azimuth-gyro-surveying instruments. Coordinate control is often based on an assumed grid. Triangulation, resection, and trilateration techniques are useless since line of sight is extremely short or nonexistent. Each survey party is augmented by brush cutters to clear the line of sight. However, due to the lack of adequate roads, the use of azimuth-gyro-surveying instruments and tellurometers for survey operations requires considerable backpacking of heavy equipment. In addition, much of the electronics distance-measuring equipment is inoperable in dense foliage and undergrowth. The use of elevating masts may make it possible to measure distances at normal ranges.

f. Tactical Employment.--Decentralization of artillery units is often necessary because of difficulties in control and communications. As a result, batteries may sometimes operate alone. Thorough reconnaissance is necessary to locate future positions. It may be desirable to have a single piece near the head of a column to place direct fire on enemy roadblocks, tanks, or bunkers. Jungle fighting is sudden and calls for quick reaction times from the artillery. Close liaison is maintained with the supported troops. In the attack, artillery concentrations and preparations are short but intense. Attacking elements of the landing force are trained to follow the fire closely. Light artillery is most appropriate for jungle warfare. The 105mm howitzer is an excellent weapon particularly in view of the ability to helicopter-transport it. Medium and long range artillery are valuable for their long range and heavy fires but can be used only if a road net is available.

5308. TACTICAL AIR OPERATIONS

In an amphibious operation, the principal missions of tactical air are to gain and maintain air superiority in the objective area, to interdict the objective area, and to provide close support to the ground forces. In jungle operations, additional air operations of particular interest to the landing force include: aerial reconnaissance and observation, artillery and naval gunfire spotting, air delivery of troops and supplies, and evacuation of casualties. Such operations are conducted in accordance with the general tactical principles and procedures delineated in FMFM 5-1, Marine Aviation.

a. Close Air Support.--Of particular concern to both ground forces and air units are the control and coordination of close air support missions. The complexity of this problem demands a combination of means to identify the target, locate friendly frontlines, designate fire support coordination lines, and observe and control airstrikes through forward air controllers and the tactical air coordinator (airborne). In cases where inclement weather or target visibility is a limiting factor, airstrikes may be controlled by air support radar teams (ASRT) or a forward air controller, directing aircraft by the portable radar beacon set (RABFAC) in conjunction with an offset bombing capability in the aircraft.

b. Airfields.--Of equal concern to ground and air units is the location, construction, and security of airfields ashore in jungle terrain. Soil trafficability and clearance of jungle vegetation magnify the construction problems of advance airfields. Once established ashore, air units and ground forces in the vicinity of the airfield coordinate their counter-guerrilla and security operations to provide maximum protection to this

important installation. Fuel areas are particularly sensitive to enemy infiltrators and guerrillas.

c. Antiair Warfare Operations.--Although the number of defended areas normally decreases in jungle operations, those subject to attack are increasingly vital. They frequently justify a higher level of defense than similar installations in another type operation. The most critical aspects of employment of antiair warfare elements are the need for reconnaissance in considerable detail, the requirements for extensive clearing of sites, and the inaccessibility of optimum positions. This may prevent the attainment of the optimum level of air defense desired by limiting the number of antiair warfare elements that may be employed ashore. Seizing offshore islands for antiair warfare installations may be an important consideration when planning for the air defense of the objective area.

5309. EMPLOYMENT OF HELICOPTERS

Employment of helicopters in a jungle environment is consistent with the general tactical principles and procedures delineated in FMFM 3-3, Helicopterborne Operations. Such employment is based upon a sound understanding of the advantages and limitations of helicopters as accentuated by the jungle environment.

a. Advantages.--The helicopter has the ability to pass over jungles and easily reach otherwise isolated places. The jungle with its heavy vegetation provides the helicopter with added concealment from ground observation. As a result, it is often hard to locate and fire on from the ground.

b. Limitation.--The payload of helicopters is greatly reduced by the high temperatures that are associated with jungle operations.

(1) Landing sites are extremely difficult to locate in the jungle.

(2) Abandoned plantations, airstrips, native village clearings, and garden areas offer some possibilities as landing sites. Roads, when not obstructed by jungle growth, can also be utilized as landing sites.

(3) Landing sites may have to be literally created by clearing the jungle growth.

(4) Navigation is extremely difficult because of the general absence of distinguishing landmarks.

5310. EMPLOYMENT OF TANKS

The jungle affects tank operations by restricting observation, fields of fire, movement, and communications, and by providing concealment from air and ground observation. These factors make control difficult and continuous contact virtually impossible. In jungle operations, the tank leader is normally faced with situations that, at best, are vague. Narrower fronts are normal, and distances between units, vehicles, and individuals are reduced. Supporting fires are restricted.

a. Movement.--Movement of tanks is limited generally to roads, beaches, and grass or brush covered fields. Cross-country movement in dense jungle is extremely difficult unless routes have either been reconnoitered

or prepared previously. Sometimes tanks can operate in an area of tree-covered hills or where treetop growth has limited the growth of undergrowth. Dozer tanks and tractors equipped with blades can be employed to widen trails for tank passage.

b. Communications.--Radio range is greatly reduced because of the screening effect of dense vegetation and irregular terrain. The effectiveness of radio depends upon its location and the atmospheric conditions. In a slow moving attack, tank units may depend more on wire, and an increased reliance is placed on messengers. Since tanks and infantry function in close quarters, the tank-infantry telephone is a primary means of tank-infantry communications.

c. Coordination.--Close coordination between tank and infantry leaders is essential during jungle operations. An exchange of radio equipment is often necessary. Information as to objectives, routes, and antitank resistance is reported by the infantry. In some instances, it may be necessary for tank commanders to move forward on foot to observe targets pointed out by the infantry. Care is taken in establishing control lines due to the sameness of the terrain and the problems of observation.

d. Maintenance.--In jungles, maintenance is a serious problem. Almost all materiel is subject to rapid deterioration because of the abnormally humid weather.

e. Planning.--Detailed planning and careful coordination of all arms are essential, extending down to every member of the individual tank crew and to the infantry squads that support them. Establishing methods of communication and target designation is especially important. The use of available routes, the requirements for construction of new routes, and the passage of swamps and other difficult ground must be planned. It is also necessary to develop a plan of supporting fires for artillery and infantry weapons that is compatible with tank fires and movement.

f. Offensive Operations.--Normal procedures for the offensive employment of tanks in jungle operations are as delineated in FMFM 9-1, Tank Employment/Antimechanized Operations. Roads, trails, and rivers are key terrain features in considering the employment of tanks. The accuracy and variety of tank ammunitions, particularly cannister/beehive ammunitions, should also be considered in the employment of tanks in this environment. During the advance, bulldozers and dozer tanks are employed extensively to maintain the continual movement of tanks. The distance between tanks is reduced due to the nature of the terrain.

g. Defensive Operations.--During the conduct of a defense in the jungles, tanks on the forward edge of the battle area (FEBA) are positioned in hull defilade behind minefields, boobytraps, and barbed wire. Dismounted tank crewmen may be employed for local tank security. Infantry units provide additional security to prevent surprise, ambush, sniping, and infiltration tactics by the enemy. Since the direction of an enemy attack can seldom be determined, tanks are provided on all-round defense. Tanks not positioned on the FEBA are employed with the reserve. Tanks are given normal defensive missions where the terrain permits, or they are employed to reinforce artillery fires.

5311. EMPLOYMENT OF AMPHIBIOUS VEHICLES

Amphibious vehicle operations in the jungle are conducted in accordance with the general tactical principles and procedures delineated in FMFM 9-2, Amphibious Vehicles. The absence of trafficable roads often precludes effective employment of wheeled vehicles. Narrow roads may have to be widened to accommodate the great bulk of amphibious vehicles. Visibility is severely reduced by jungle growth and vegetation. When navigable waterways are available, amphibious tractors may be the principle vehicle available to the commander for the lift of personnel and equipment. In such situations, the amphibious howitzer may prove particularly valuable.

a. Mobility and Security.--Cross-country movement is very difficult, even for tracked vehicles, and mobility is drastically decreased. As a result, the need for local security of amphibious vehicles increases. Without such security, enemy antitank personnel are able to approach tracked vehicles without detection. Efficient reconnaissance of routes and engineer assistance allow the amphibious vehicles to cover many routes which might appear impassable to the inexperienced.

b. The LVTH as an Artillery Weapon in the Jungle.--The LVTH, when available, is suited to employment as an artillery weapon during jungle operations. It is self-propelled and full-tracked allowing it greater mobility. Its ability to displace, utilizing rivers, streams, and otherwise impassable terrain, provides greater mobility to the landing force artillery. When unable to fire from a given position because of overhead limitations, the vehicles can be moved with a minimum of delay into an effective firing position. The 360-degree traverse capability of the weapon and the ability to fire from most locations, are valuable assets for a weapon during jungle fighting. The bulk and size of the LVTH require wider jungle access ways than does conventional artillery.

c. Logistic Considerations.--Resupply of amphibious vehicles in the jungle is complicated by the environment. The internal storage of artillery ammunition in the LVTH ensures proper storage without deterioration prior to firing. Supply of fuel, water, and lubricants, always important to the amphibious vehicle unit, may be a problem. If it is the only vehicle able to negotiate the terrain and reach elements committed inland, the amphibious tractor's most important role in jungle operations may well be that of a supply vehicle.

d. Vehicular Considerations.--The climatic conditions encountered in jungle areas have a deteriorating effect on all metals, rubber, and in particular, working parts of weapons or vehicles. Rust forms quickly, and preventive maintenance requirements are strict. Lubrication of working parts is accomplished daily. Oil levels are checked and maintained at maximum capacity. Communication equipment, to include antenna mounts, is inspected and lubricated as necessary. Moisture renders equipment unserviceable rapidly unless preventive maintenance procedures are thorough and continuing.

5312. NUCLEAR WEAPON CONSIDERATIONS

The dense jungle vegetation is an important factor in the employment of nuclear weapons. Even though the effects of nuclear explosions will not be significantly affected by the vegetation, the blast effect will create considerable tree blowdown and missile effects. Tree blowdown may severely

restrict movement and may increase or decrease fields of fire. During the dry season, fires may be started in dry brush and flammable supplies by the thermal effects. The intensity of radiation from radiological agents and radioactive fallout may be reduced by extremely heavy vegetation as some of the particles will be retained by the jungle canopy. Should subsequent rains wash the particles to the ground, decontamination procedures must be followed.

5313. CHEMICAL CONSIDERATIONS IN JUNGLE OPERATIONS

The hot, humid jungle climate, coupled with the blazing sun and tropical downpours, is considered in the employment of toxic chemical agents. Wind speed and turbulence are low in jungles and increase the persistence of toxic clouds.

a. Nonpersistent Chemical Attack.--Nonpersistent chemical attacks are effective against enemy troops in strong defensive positions that are difficult to destroy with high explosives. Since jungle operations are necessarily slow and deliberate, time is usually available for long preparatory nonpersistent chemical fires. For some munitions, wooded and jungle areas require larger munition expenditures because some rounds detonate on tree tops, with consequent loss of the effect of chemical agents at ground level. Air delivery of toxic chemical agents is effective.

b. Persistent Chemical Attack.--In defensive operations, the enemy's avenues of approach to landing force positions may be blocked with barriers and obstacles. Persistent chemical attacks may be added to these barriers to hinder the advance of hostile troops. When the approach of enemy forces is canalized by a scarcity of trails, chemical land mines integrated into the defensive barrier system add considerable value to a minefield.

5314. EMPLOYMENT OF ENGINEERS

The employment of engineers in the jungle environment is consistent with the general tactical principles and procedures delineated in FMFM 4-4, Engineer Operations. Due to restrictions imposed on movement by the terrain, the speed with which jungle operations are conducted is affected more by engineer capability than is the case in normal operations.

a. Road Construction.--Numerous factors complicate road construction in the jungle. The heavy rainfall in these areas imposes a drainage problem of major concern. Whenever possible, low ground is avoided in laying out a road. When it is impossible to bypass low, swampy ground, road construction is difficult. A first step is probably a corduroy road. (See fig. 44.) It is advisable to cut the right-of-way much wider than normal so the sun can dry out the roadbed. The enlarged right-of-way also provides room for the construction of the ditches necessary to keep the subgrade drained. Landing force engineers engaged in such operations need heavy construction equipment. Additional bulldozers and other construction equipment are procured for supporting engineer units or installations. If the road net permits, an alternate route plan is set up so that main roads or sections of them may be closed when they need major repairs.

b. River Crossing.--In large-scale jungle operations, when time and equipment are available, the standard river crossing procedures, bridging, and stream crossing expedients described in chapter VI of this manual are applicable. In small scale operations, or as field expedients, the rope

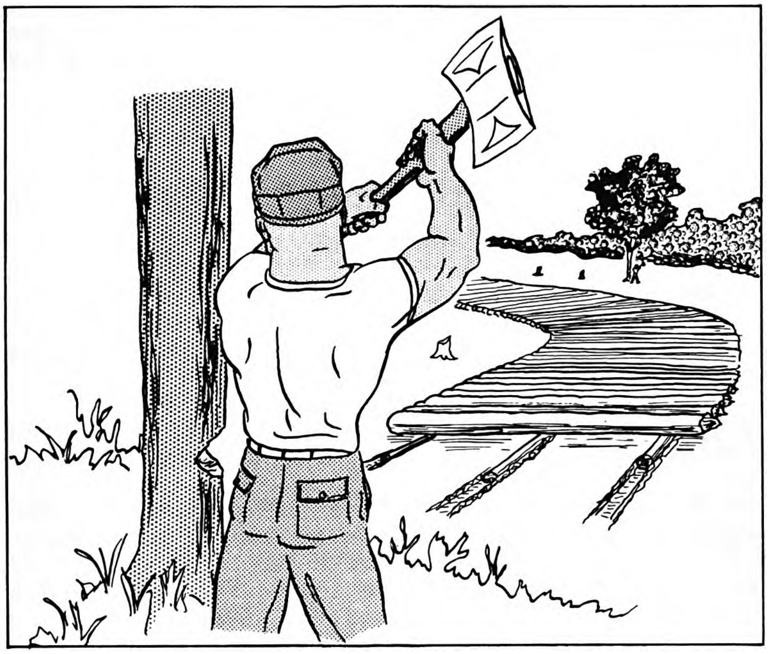


Figure 44.--Constructing a Corduroy Road.

suspension bridges and the suspension cable way, described in FM 31-72, Mountain Operations, and TM 5-279, Suspension Bridges for Mountain Warfare, may be employed. The jungle provides excellent concealment for river crossing operations in most instances. Troops and hand-carried material can be brought up to almost any desired site without additional road construction. However, when selecting the site, the climatic conditions of the area pertaining to the annual rainfall and flooding conditions are carefully analyzed. Flash floods are characteristic of most jungle areas, even in dry season. When heavy equipment is to be used, the road construction required and soil trafficability are considered.

c. Water Supply.--Water sources are usually abundant, but special treatment is required due to the presence of resistant organisms.

d. Mine Warfare.--Since the jungle itself is an effective obstacle against vehicles, antitank mines and other antivehicular obstacles are normally confined to roads, trails, and occasional patches of cleared ground. Antipersonnel mines are usually incorporated into defensive plans to delay and divert the enemy and to serve as warning devices.

e. Mapping.--Because of the inaccessibility of jungle areas, adequate maps are scarce, and those that are available are frequently inaccurate except for the location of coastlines and principal rivers. The numerous unnamed swamps, streams, inlets, and lagoons are seldom indicated, and contours, if shown, are seldom accurate. The trail nets shown can seldom be depended on because trails are rapidly reclaimed by the jungle. Native towns and villages frequently bear native names entirely different from those on the maps. This is also true of many terrain features. Any information that can be used to correct existing maps is forwarded to the appropriate headquarters for prompt dissemination.

f. Reconnaissance.--Engineer reconnaissance to supplement the data on maps is of prime importance. Engineers require information on the following topics:

(1) Location and condition of roads and trails.

(2) Location of road construction and building materials.

(3) High water level of streams.

(4) Condition of banks at river crossing sites.

(5) Location of water sources for drinking, laundering, and bathing.

g. Planning.--In planning for jungle operations, the unusual demand for heavy construction equipment is a major consideration and engineer forces are reinforced accordingly. The jungle provides an abundant supply of timber, and it is often desirable to establish a sawmill to provide lumber. Provisions are also made for the treatment of piling and other bridge material to retard decay and/or withstand the ravage of termites. Sandbags disintegrate rapidly in the jungle, and when they are used, a supply must be available for replacements.

h. Overcoming Obstacles.--The obstacles resulting from effects of nuclear weapons in jungle terrain generally are easier to bypass than overcome. In a tactical situation, the time and engineer effort required to cross nuclear blowdown areas are excessive. Alternate routes of movement are planned and prepared as soon as possible to provide means for continuing movement despite nuclear attack.

Section IV. LOGISTICS AND COMMUNICATIONS

5401. GENERAL

All logistic and communication functions become more difficult to execute efficiently in the jungle environment. The availability of trails, roads, and waterways; the density of natural growth; the season; and general terrain conditions have a direct influence on the type of transportation that can be used and, consequently, on the functioning of supply systems. Logistic requirements are, of necessity, planned well in advance of actual needs. Careful planning is needed to conserve materiel and transportation. Strict control of all classes of supply is required in order to exclude surplus and nonessential items.

5402. SUPPLY

Supply capabilities of landing force elements engaged in jungle operations influence the extent of operations, rates of movement, and the strength of forces employed. The character of the jungle terrain affects the type of transportation that can be employed and directly influences the amount and type of supplies carried. The use of aircraft for supply or resupply operations often provides the best means to support operations.

a. Requirements.--Supply requirements are carefully planned. Landing force elements overburdened with supplies and equipment are of little value in the jungle. Only items which are absolutely required are carried.

b. Delivery.--Timely delivery of supplies to using units is vital. Since movement in the jungle is so restricted, continuous reconnaissance of routes is made to keep supplies close to the using units. Whenever possible, alternate supply routes and sites for supply installations are selected in advance. When suitable routes do not exist, it may become necessary to construct roads or trails to ensure delivery of supplies to units.

c. Transportation.--Plans for the delivery of supplies ensure that proper and adequate transportation is available when needed. This requirement may be met by men carrying the needed supplies. This may require that supplies be broken down into loads of from 40 to 60 pounds. This is particularly true in the case of ammunition resupply which is one of the most difficult of the logistic problems.

d. Deterioration.--Supplies deteriorate rapidly in the jungle. This is considered when setting up resupply levels. Special provisions are made to protect supplies from climatic conditions. Cover in the form of tentage, tarpaulins, prefabricated huts, or thatched shelters is necessary to provide protection from heavy rains and hot tropical sunshine. Dunnage or platforms are required to keep supplies off the wet ground.

e. Rations.--As in all operations, every effort is made to provide hot food. However, rations for jungle operations normally consist of nonperishable canned and dehydrated items. The decentralized nature of jungle operations requires individual and small detachment rations. Water sources are plentiful in jungle areas but more often than not are polluted. Halazone tablets provide the individual purification of small quantities of

water. It may become necessary to secure additional water purification means to supply the units. Water supply in jungle operations is a constant problem.

f. Critical Items.--Clothing, particularly shoes and socks, and other items of supply, deteriorate more rapidly. Additional quantities and replenishment are required of the following items:

(1) Hand tools and portable power tools.

(2) Spare parts for vehicles.

(3) Storage tents and tarpaulins.

(4) Water purification tablets and chemicals.

(5) Moistureproofing and fungusproofing kits.

(6) Batteries.

(7) Insect and rodent control items.

(8) Medical supplies.

(9) Stream crossing equipment.

g. Construction Materials.--Increased quantities of construction material, beach and road mats, and bridging material are required. In addition, certain items especially designed for use under jungle conditions may be needed. These include:

(1) Special medical kits.

(2) Packboards.

(3) Lightweight clothing.

(4) Tracked vehicles and trailers.

h. Ammunition.--Jungle operations may require increases in the supply of various types of ammunition. For example, to obtain good area coverage, more ammunition is needed because of the heavy vegetation. More white phosphorous smoke is required during adjustment and to mark targets. The jungle has a definite effect on the fuzes employed. All these are considered when determining the ammunition requirement for jungle operations.

5403. TRANSPORTATION

Organic transportation, especially within units of regimental size or smaller, is usually not sufficient to take care of logistic requirements. It is generally necessary to provide additional motor transport support.

a. Amphibious Vehicles.--The M116A1 (Husky) and the amphibious tractor have the ability, within limitations, to traverse the trails, swamps, and mud of the jungle. They are capable of smashing their way through light jungle growth, or crossing rivers with slow moving currents, and traversing lagoons with firm bottoms or a minimum depth of 3 feet of water.

b. Porters.--Native porters can carry a 35- to 40-pound load for 6 to 7 hours. In flat country with good trails, they can cover 15 miles in a single day's march; in upland country with poor trails, 3 to 5 miles a day are average. Their logistic support (including food, pay, and shelter) must be planned.

c. Water Transportation.--When navigable rivers, seacoasts, or lakes appear within a unit's zone of action, every opportunity is taken to employ water transportation. Transportation by water is faster and there is less strain on men and material than that required by cutting a trail through the jungle. Operations along a coast present maximum opportunity for the use of water transportation. To facilitate operations, the requirement for water transportation is planned in advance to include use of LCVP's, LCM's, and LCU's.

d. Rotary-Wing Aircraft.--Rotary-wing aircraft may well be the most economical means of transportation in many jungle situations. However, the hot and humid air encountered in tropical jungles decreases aircraft performance, resulting in reduced vertical ascent, hover, and lift capability. This can be partially offset by employing stable surface landing zones.

5404. MAINTENANCE

The care, cleaning, and maintenance of all equipment are major factors during jungle operations. Evacuation of damaged equipment is difficult because of restricted mobility. Maintenance plans provide for placing maintenance units as far forward as possible and for extensive use of contact repair teams.

a. Weapons.--Muzzles and other apertures are protected with suitable covers. Weapons require cleaning more often than in other terrain. Rust preventatives are used frequently on all exposed metal surfaces.

b. Communications and Fire Control Equipment.--Mildew and condensed moisture damage this equipment. Servicing of optical equipment requires trained personnel.

c. Vehicles.--Vehicle maintenance and jungle driving present special difficulties resulting from the heat and terrain.

(1) The heat and humidity cause rusting and corroding of all metal parts. Mildew affects all tarpaulin covers. Tires and rubber items are kept dry until used. Battery electrolyte tends to evaporate in hot weather and is checked daily.

(2) Vehicles operating in the jungle become covered with mud. Frequent washing of vehicles prevents excessive damage to the vehicle from mud working into operating parts.

(3) Driving at low speeds and in low gear over jungle trails causes overheating. Drivers should stop frequently and run engines at a higher r.p.m. to speed the water circulation. Drivers should make sure vegetation does not screen air from reaching radiator.

(4) Vehicles many times become bogged down in swampy ground. It is difficult to dig them out, and in most cases, they have to wince themselves out or be pulled out by bulldozers. Vehicle winches are inspected

daily. All drivers receive training on winching procedures for extricating vehicles.

5405. MEDICAL

The manner in which medical units support landing force elements depends on the employment of the supported unit. Wide variations may be expected at division level and below. Employment of medical support elements is complicated by extreme moist heat, prevalence of disease, and the difficulty of traversing terrain with casualty loads. When practicable, plans to utilize native litter bearers are established prior to entry into combat. Medical equipment may require modification to permit maximum efficiency in combat. This may include establishment of pack equipment for all medical installations and the replacement of wheeled ambulances with other evacuation means appropriate for use in jungle terrain.

a. Personal Hygiene and Sanitation.--The problem of personal hygiene is a serious and continuous one in the jungle. A determined and continuing effort by commanders at all levels is made to provide sanitary facilities for their troops.

b. Jungle Diseases.--Troops arriving in jungle areas are exposed to many diseases with which they are not familiar. The level of sanitation in jungle areas among the native inhabitants is frequently very low. Furthermore, there is often great difficulty in enforcing even the simplest sanitary regulations, because many natives are too ignorant, superstitious, and lazy to cooperate.

(1) Water supplies are grossly contaminated, and there are no modern water supply systems. Rainwater catchments are used in some areas. Most natives use shallow, poorly protected wells, or drink from streams. There are no sewerage systems, and natives are unwilling to use latrines. Animals and some natives dispose of body waste promiscuously, even directly into the streams used for drinking water.

(2) The diseases of greatest military concern are malaria, filariasis (elephantiasis), intestinal diseases, venereal disease, dengue (breakbone) fever, yellow fever, scrub typhus, and typhus fever. Of these, malaria is the most prevalent in all seasons. Common diarrhea and amoebic and bacillary dysentery are the most frequent intestinal diseases, but typhoid and paratyphoid fever also occur. Gonorrhea is the commonest form of venereal disease, but syphilis, chancroid, and granuloma inguinale are fairly prevalent. Fungus infections are frequent, as are other skin diseases. Tropical ulcers are particularly common. Parasitic infections, heat exhaustion, sunstroke, and pneumonia may affect a number of troops.

c. Evacuation.--The evacuation of wounded in jungle warfare presents a difficult problem. The task of carrying a casualty to the medical installation may require the traversing of rough terrain. There is a higher proportion of litter wounded cases than ordinarily encountered, since even a slightly wounded individual may find it impossible to struggle over rough terrain. As a result, the casualty ordinarily classified as "walking wounded" may become a litter case.

(1) Equipment.--The usual equipment and property prescribed for units concerned with evacuation are not always suitable for operation under jungle conditions. Ambulances have difficulty on jungle trails, in swamps,

and on unimproved muddy roads rutted by heavy traffic. For this reason, other types of vehicles, LVT's, and helicopters may be used for transporting the wounded. All types of transportation, whether by water, land, or air, may be used to transport casualties to the rear. This applies not only to vehicles assigned primarily for this purpose, but also to empty supply vehicles returning from forward positions. Evacuation in the jungle is normally along supply routes which are adequately protected against enemy action. Boats, rafts, and ambulance barges may be used for short distances when practicable to evacuate by water. When open terrain or water permits landing and takeoff, fixed-wing aircraft and helicopters provide an excellent and rapid means of evacuation.

(2) Litters.--The standard folding litter has some disadvantages when evacuation involves the crossing of streams, gullies, and steep slopes. Metal basket litters (mountain type) are more practicable under these conditions and can also be used to advantage when casualties are being moved from jungle areas to ships for evacuation by water. The metal basket litter can be used with the cacolet type pack saddle to evacuate casualties by pack animal. Native litter bearers may prefer to use ordinary canvas sheets with loops for poles. The canvas sheeting is light, and poles may be cut when needed. All available means for collecting and transporting the sick and wounded must be used to do the job satisfactorily. Ordinarily no one method will suffice.

(3) Human Factors.--It is easy to overestimate the strength and endurance of litter squads. Well-conditioned men, carrying a patient on a litter for 400 to 600 yards over jungle terrain, are unable to repeat the performance without an appreciable amount of rest. Surgeons must keep their commanders informed of the adequacy and efficiency of the evacuation system, and commanders must provide additional natives when practicable and, at times, men from other units of the command. No man should be evacuated who may be treated locally and returned to duty.

5406. COMMUNICATIONS

a. General.--Standard communication systems and techniques delineated in FMFM 10-1, Communications, are normally employed in jungle operations. However, jungle terrain does limit normal use of communications. The greatest limitations are caused by vegetation and irregular terrain. Correct installation, utilization, and operation of communication equipment must be emphasized. Special attention in training must be given to employment of expedient antennas to boost radio transmission and reception.

(1) While all equipment for use in the tropics must be capable of functioning efficiently in a high temperature, temperatures alone do not cause the greatest difficulties. Wetting by salt water or salt spray in the landing operation and inadequate storage facilities cause much damage. Continuous damp, warm air causes a general disintegration of most types of insulating material.

(2) Fungus growth often reduces the wire insulation resistance to such an extent that service is interrupted. Under tropical conditions, fungus may form in a day or two on the edges of insulators and in keys and jacks causing short circuits. Insects also create maintenance problems.

(3) Before beginning jungle operations, every possible measure is taken to dry out and protect equipment. The care of communication

equipment is of special importance in the rainy season. It is moisture-proofed and fungus-proofed to provide protection against fungus growth, insects, corrosion, and salt spray. The treatment, which is designed for field application, consists of spraying or brushing on a moisture and fungus-resistant varnish. It is applied prior to arrival when possible and in every case prior to issue for use in the jungle. Even after this treatment, additional precautions are necessary. Waterproof covers are an added protection. When covers are not issued, they can be made from salvaged material. Communication equipment is kept off damp or wet ground.

b. Wire.--During operations in the jungle, all means of communication are adversely affected. Dry batteries deteriorate more rapidly than normal, even when not in use. At least twice the normal supply for operations in temperate zones is required. Ground wire routes are limited, and the few available routes are normally heavily traveled making overhead construction imperative. When laying wire along trails, care should be taken to ensure that the wire line is well off the trail. Communication personnel must be well trained to observe this precaution. One of the advantages of ground-laid wire is its ease of maintenance, provided that it is laid properly in the beginning. The laying of wire by helicopter over the canopy of the jungle is extremely fast and saves the expenditure of physical effort by communication personnel. The distance wire can be laid by helicopter is limited only by the carrying capacity of the helicopter. Compromise of air-laid wire is difficult as the wire generally lies on top of the canopy of the trees. A limitation of air-laid wire is that a positive signalling method must be utilized between the helicopter and the units on the ground. The pilot must not only know the exact spot to start laying wire but also exactly where it is to be terminated. A weight and a marker should be tied to the dispenser as it is dropped, marking the wire as it lands in the jungle. Maintenance of air-laid wire is extremely difficult because the wire lies on the tree canopy, and in most cases, it is easier to lay a new line than repair one no longer operational. The primary limitations on the use of ground wire lines in jungle operations are the reduction of talking range due to moisture and the increased probability of enemy infiltration and wire tapping.

c. Radio.--Although radio communications in the jungle are highly desirable, particularly in the attack, the normal operating range is seriously reduced by dense vegetation and adverse atmospheric conditions. Radio operators are trained to copy weak signals and to use every expedient possible in siting and constructing antennas. Remote control equipment may be helpful in gaining a more favorable location of the radio set. Radio sets may have to be hand transported and hand operated. Substitution of man packed sets for vehicular sets may be necessary. Aircraft can assist greatly in ground communications by acting as radio retransmission stations and by making terrain surveys for radio retransmission sites. Helicopters can be used to transport personnel and equipment to selected sites enabling the installation of important circuits with maximum speed. Aircraft may also be used to supply operating communication personnel with rations, POL, and maintenance parts.

d. Messenger.--The messenger is one of the most reliable means of communication in jungle operations, particularly in lower units. Except when roads are available, motor messengers are of little value. Aerial messenger service using drop and pickup techniques may be employed to augment ground messenger service whenever conditions permit. The helicopter is our most desirable means for carrying messages. Thus, obstacles confronting

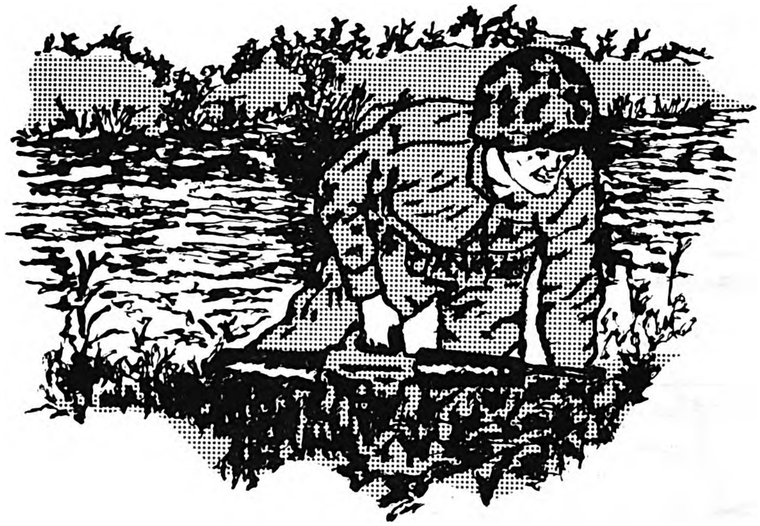
ground messengers in tropical areas may be largely overcome. Messengers are carefully selected. They require a high degree of intelligence, courage, and aggressiveness. This is due to the fact that in tropical areas, the obstacles they will face will be more difficult to overcome than in any other area. Therefore, their training will include instructions in jungle lore, trail knowledge, map and compass reading, and escape and evasion. In the jungle, messengers should be employed in pairs.

e. Sound.--Sound can be used to great advantage in the jungle, particularly as a prearranged signal for security units and patrols. In considering mechanically produced sound, it must be noted that the heavy foliage of jungle cuts the distance this sound will travel. Therefore, when planning for the use of such a signal, tests should be conducted to determine whether or not the signal is adequate. Such sounds as those produced by whistles or by striking the butt of a rifle with a rock or stick are examples of sound devices that can be used. Even jungle drums and hollow logs may be utilized to send messages by transmitting prearranged codes.

f. Visual Communications.--Visual communications include the transmission of messages by flags, panels, and pyrotechnics. Its use is limited by the density of the jungle. Areas in which panels may be used are scarce.

(1) While it is fundamental that lamp signals are sent only from front to rear, situations occur in jungle operations in which such communications are permissible in both directions. Lamp stations are concealed from enemy observation and are generally located along straight stretches of trail. Either white, red, or infrared beams may be used. In general, the white beam is visible at greater distances by night; the red beam by day. In fog and smoke, the red beam is more satisfactory. A flashlight with an improvised reflector may serve as a signal lamp, or a lantern with an improvised movable cover may be used.

(2) Pyrotechnics and smoke may be used as signals between individuals, units, and from ground to air, or air to ground. They are visible over a greater distance when employed against terrain of contrasting color. Green smoke and white smoke are considered poor signalling devices in jungle terrain. Green, once dissipation begins, tends to blend with the green foliage and is difficult to distinguish from anywhere but a short distance. White, once it begins to rise, resembles ground fog or low hanging clouds or haze. Due to the striking contrasts of color, red smoke and yellow smoke are very effective signalling colors in the jungle.



CHAPTER 6

RIVER CROSSING

Section I. GENERAL

6101. INTRODUCTION

Proper utilization of amphibious means, tactics, and techniques permits Marine air-ground forces to overcome inland river obstacles. This fact has been demonstrated in training and in combat during recent years. Many amphibious exercises conducted by the 2d Marine Division and the 2d Marine Aircraft Wing at Onslow Beach, North Carolina, involving the crossing of the Inland Waterway; the 1st Marine Division's crossing of the Han River prior to the seizure of Seoul, Korea in 1950; the helicopter troop and supply lifts across the Han and Imjin Rivers during training exercises in the 1st Marine Division Sector in 1952 and 1953; and the numerous combat/combat support operations conducted in Vietnam have provided a wide variety of experience in techniques for overcoming river obstacles. This chapter outlines the tactics and procedures employed by a landing force in a river-crossing operation. For more detailed information concerning river-crossing operations, see FMFM 8-4, Doctrine for Riverine Operations, and FM 31-60, River-Crossing Operations.

6102. DEFINITIONS

a. Bridgehead.--A bridgehead is the area on the hostile side of the river which is seized and secured by assault elements of the landing force. The area should accommodate and facilitate maneuver of the crossing forces without congestion, provide protection for the crossing of the remainder of the force, and provide a base for future landing force operations.

b. Crossing Area.--A crossing area is that portion along a river which contains bridge and raft sites, the assault crossing sites required to

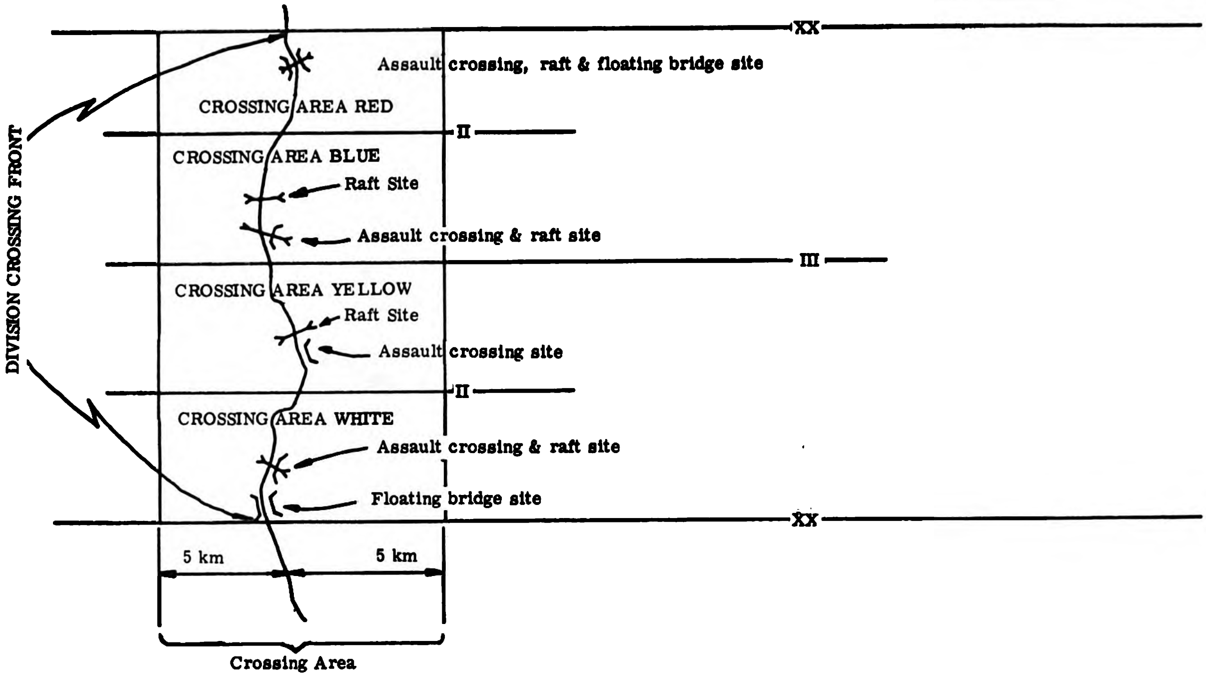


Figure 45.--River-Crossing Front and Areas.

secure the bridge and raft sites, and the surrounding terrain which is subject to the effects of enemy fires concentrated on the crossing sites. (See fig. 45.) The radius of damage for the largest enemy tactical nuclear weapon is considered when determining the depth to which the crossing area extends on both sides of the river.

c. Crossing Front.--A crossing front is the length of the river line in a unit's zone of action. (See fig. 45.)

d. Crossing Site.--Crossing sites are the location where bridge, raft, and assault crossings can be made within a crossing front. (See fig. 45.)

6103. NATURE OF A RIVER-CROSSING OPERATION

In a river-crossing operation, the immediate objective is to get assault elements of the landing force across the river quickly and economically and to establish a bridgehead which will protect the balance of the crossing force and maintain the momentum of the assault. River-crossing operations vary in many respects from other operations conducted ashore by a landing force. The chief differences are:

a. There is a requirement for special equipment and specially trained personnel.

b. Command and control of landing force elements during a river crossing are detailed.

c. Tactical courses of action are limited, since the ability to maneuver is restricted during the time elements of the landing force and their heavy equipment are astride the river.

d. Once forces and equipment are committed to action, withdrawal or deviation from the landing force's initial plan of action is difficult or impossible.

6104. TYPES OF RIVER CROSSINGS

River-crossing operations may be categorized as crossings of opportunity, hasty crossings, or deliberate crossings.

a. Crossing of Opportunity.--The crossing of opportunity is an unplanned crossing which is normally the byproduct of a routine offensive operation. Occasionally, it is made possible through the capture of intact fords or bridges by a force which either had not planned the crossing of the river or did not have the means to cross the obstacle readily available. The capture of the Ludendorff Bridge across the Rhine River at Remagen during World War II is a classic example of the crossing of opportunity.

b. Hasty River Crossing.--A hasty river crossing is a planned river crossing conducted with a minimum loss of momentum by assault elements of the landing force. Fire support and crossing means are made available to assault elements on arrival at the river. The hasty crossing is characterized by speed and surprise, minimum concentration of forces, decentralization of control of specific crossing times to subordinate assault elements, and extensive prior planning to allocate the required crossing means available to the force executing the crossing. The hasty crossing is preferred.

c. Deliberate River Crossing.--A deliberate river crossing is a planned river-crossing operation which requires a buildup of the crossing force and crossing means to overcome the barrier and enemy defenses on the far shore. The enemy is cleared from the near shore prior to the attack of ground assault elements of the landing force. Detailed plans and preparations are made for a coordinated assault on the far shore. Normally, a deliberate river crossing is conducted only when one of the following conditions exist:

(1) The landing force is moving from a defensive to an offensive posture.

(2) A hasty river crossing is not feasible.

(3) A hasty river crossing has failed.

6105. PHASING OF RIVER-CROSSING OPERATIONS

a. Traditional Concept.--River-crossing operations have traditionally been divided into three phases. These phases serve as control measures. They restrict maneuver by imposing requirements for specific actions on landing force units during the course of the attack. (See fig. 46.) Phase lines are designated as 0-1, 0-2, and 0-3. Each phase is tied to the river. They are selected in terms of terrain objectives required to place limitations on enemy fires at the river line.

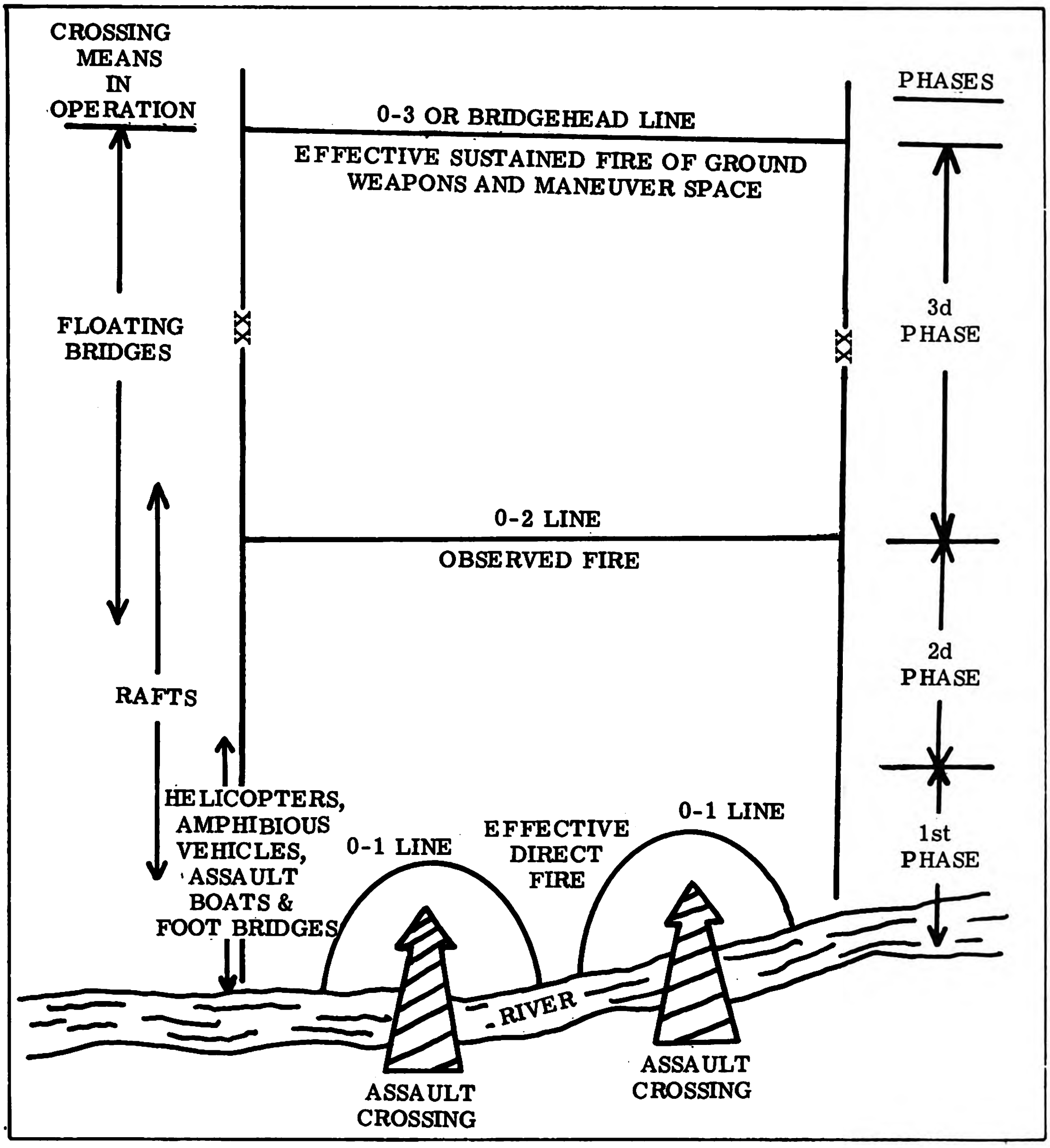


Figure 46.--Phases of a River Crossing (Schematic).

(1) Phase One (0-1 Line).--Phase one begins with the launching of the assault crossing from the near shore and ends with the securing of objectives which eliminate the enemy's capability to place effective direct fire on the crossing sites. A line connecting these objectives is the 0-1 line and includes the 0-1 area. When this phase is completed, the crossing of troops and equipment by boats, rafts, and footbridges is facilitated and work can begin on the assembly of bridges.

(2) Phase Two (0-2 Line).--Phase two is defined as the securing of objectives which eliminate the enemy's capability of placing observed

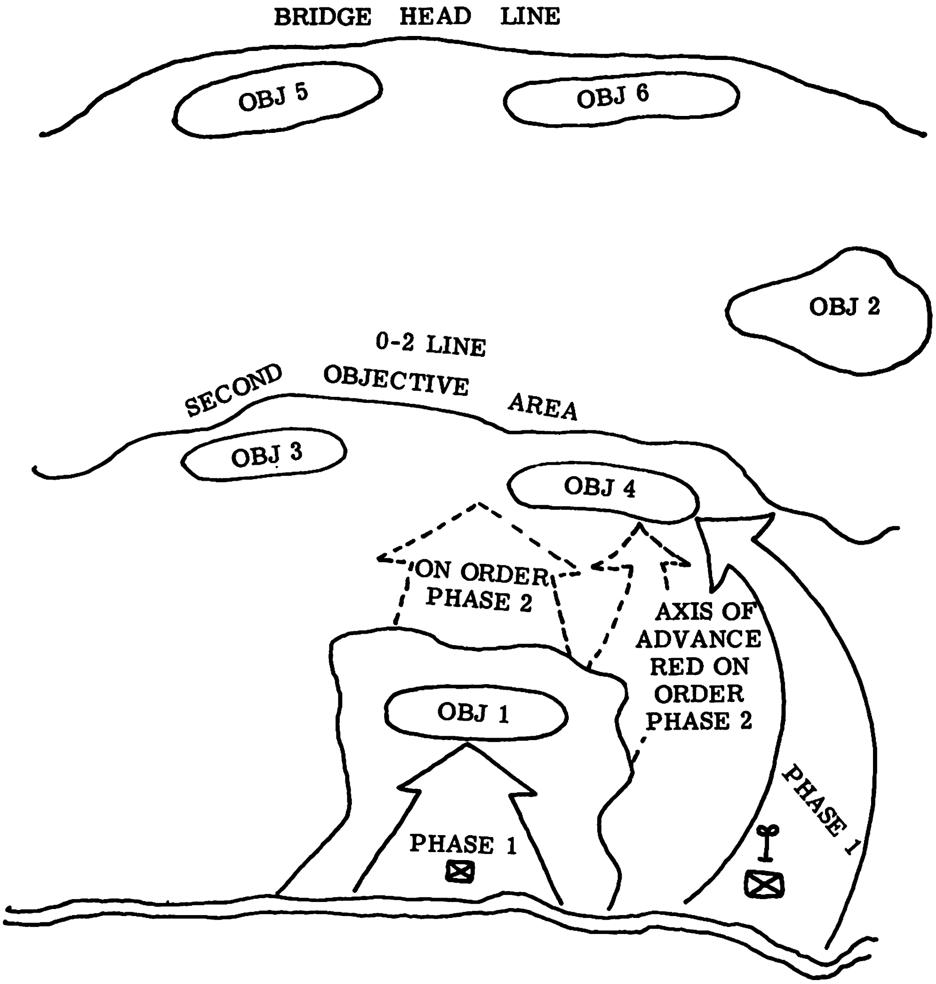


Figure 47.--Two-Phased River Crossing.

fire on the crossing sites. The seizure of objectives near the limit of visual observation completes this phase (about 8,000 meters).

(3) Phase Three (0-3 Line).--Phase three is the securing of objectives which eliminate the enemy's effective sustained fires of ground weapons on the crossing sites and provides space on the enemy's side of the river for the maneuver of the landing force. In actual operations, the fire of some of the enemy's ground combat weapons continues to fall at the river line after objectives on the 0-3 line have been reached. However, to be effective, this fire must be sufficiently accurate and of such frequency as to halt or interfere seriously with the operations at the river line.

b. Current Concept.--Under modern conditions of combat, using helicopters and amphibious vehicles, it will be a rare case if such phasing as

EQUIPMENT UNIT	MARINE DIVISION	FORCE RECONNAISSANCE COMPANY	AMPHIBIOUS TRACTOR COMPANY	BRIDGE COMPANY
Boat, reconnaissance, pneumatic, 7-man	15 (ReconBn)	18		6
Landing vehicle, tracked, personnel (LVTP7)			43	
Landing vehicle, tracked, command (LVTC7)			3	
Landing vehicle, tracked, recovery (LVTR7)			1	
Bridge, floating, aluminum, foot				6
Bridge, fixed, floating, aluminum, 60-ton rated capacity (M4T6)				3
Bridge, fixed, aluminum highway type (M6)				3
Boat, bridge erection, inboard engine, 2-section aluminum, 27-foot long				3

Figure 48.--River-Crossing Equipment.

was used in World War II is employed. In a normal Marine Corps operation, employing an assault force of reinforced division size, a one-phase operation involving a single sustained attack to secure the 0-3 line is normal. It involves the seizure of key objectives on the bridgehead line by helicopterborne forces, coupled with a surface crossing employing amphibious vehicles, followed by a rapid linkup of the two elements. When the Marine division is operating as a part of a larger force, and the bridgehead is of proportionately larger size, a two-phased operation may be employed. In this case, an 0-2 line is established short of the bridgehead line. (See fig. 47.) The 0-2 line includes objectives that remove enemy ground observation on the crossing sites and provides the assault division or divisions with sufficient space to reorganize for continuing the attack to seize the bridgehead line. In such a case, the key 0-2 objectives are seized by the helicopterborne force and linkup is effected by the surface force. This action is followed by a second phase to secure the bridgehead line.

6106. RIVER-CROSSING MEANS

The wide variety of river-crossing equipment available to a landing force is depicted in figure 48. Helicopters and amphibious vehicles constitute the principal assault means. They are discussed in detail in section 4 of this chapter. Bridging equipment such as bridges, rafts, and ferries organic to the force bridge company are the principal means for crossing the landing force's heavy rolling stock. These means are discussed in detail in sections 5 and 6 of this chapter.

Section II. INTELLIGENCE IN RIVER-CROSSING OPERATIONS

6201. GENERAL

Intelligence procedures and requirements for a river-crossing operation are essentially the same as for other operations. They are planned and executed in accordance with standing operating procedures delineated in FMFM 2-1, Intelligence. One difference is that river-crossing operations require more information of a technical nature. Emphasis is placed on engineer intelligence requirements, since a large amount of detailed engineering data is vital to planning. Military intelligence is promptly disseminated to commanders retaining primary responsibility for planning and overall control of river-crossing operations, and includes comprehensive information of the following:

a. Enemy Capabilities.--Capabilities of the enemy to oppose the crossing, to include enemy tactics; availability and effectiveness of enemy air support; courses of action open to the enemy after a bridgehead has been established; the enemy's nuclear capability; and possible use by the enemy of floating debris, mines, and swimmers to interfere with rafts and bridges.

b. River Characteristics.--River characteristics, to include width and depth of the stream and its fordability by troops, vehicles, and animals; velocity and character of the current; the height, slope, and condition of banks; sufficient hydrographic data to determine the effects of possible flood conditions; pertinent tidal data; type, condition, and gradient of the river bed; locations of dams and other manmade structures and their effect on the river characteristics; flood and ice conditions; trafficability of access roads to and from the river; sandbars, islands, wrecks, and underwater obstacles in the river; and personnel and vehicular mines and obstacles.

c. Obstacles.--Natural and manmade obstacles, to include data on location and extent, and their possible effect on the movement of troops and vehicles.

d. Terrain.--Tactical effect of terrain, to include critical terrain features on both sides of the river; information concerning assembly and dispersal areas; cover and concealment near the crossing sites; best avenues of approach to the river and to objectives on the far side; routes for wire laying and wire crossing sites along the river; positions for supporting weapons, observation posts, and supply and service installations; enemy defensive use of the terrain and terrain objectives; and space for maneuver and reorganization of landing force elements.

e. Roads.--Description of road nets, bridges, and approaches, to include condition, width, surface, and capacity of roads; capacity, condition, type, and defenses of existing and/or damaged bridges; conditions of any existing fords; extent of concealment and cover afforded along routes of approach; data regarding routes of advance beyond the projected bridgehead; and rail nets near the crossing sites.

f. Crossing Sites.--Available assault crossings, bridges, and ferry sites, to include location and characteristics of each and the location of sites for equipment parks and assembly areas.

g. Local Resources.--Local resources in the area, to include information on available timber, structural steel, hardware, wire, tools, sand, gravel, boats, barges, and ferries; local labor resources; and production facilities for steel, other metal products, and lumber.

h. Weather.--Meteorological forecast, to include light data, haze, fog, and cloud conditions as they affect visibility on the ground and in the air; and wind velocity and direction as it affects the use of smoke, chemicals, and helicopterborne operations of the landing force.

i. Logistics.--Logistic information, to include possible locations for dumps, depots, parks, clearing stations, hospitals, and other necessary installations; and routes of supply, evacuation, and communications.

6202. HELICOPTER LANDING AREA SURVEY

Reconnaissance for river-crossing operations extends to the preparation of helicopter landing area surveys. A helicopter landing area survey involves the collection of data describing the characteristics of proposed or selected helicopter landing zones. Reconnaissance troops are normally involved in clandestine surveys and are used to collect or verify any or all of the required data. A reconnaissance conducted to obtain information about the enemy in or near a helicopter landing area is not a landing area survey even though such information, when collected, is always included in the survey report. For a detailed discussion of the helicopter landing area survey report, see FMFM 3-3, Helicopterborne Operations.

6203. RIVER RECONNAISSANCE

Extensive collection of technical data on the river, the terrain, and the enemy positions is begun by major units of the crossing force well before the river is reached. The river is studied on large scale maps and by means of special geographic descriptions. Information is obtained from the files of local highway and river organizations, from prisoners of war and local inhabitants, and from ground and aerial reconnaissance.

a. Maps and Climatological Tables.--Extensive studies are made of the geological and topographical nature of the ground on both sides of the river. Maps containing this data are prepared, together with climatological tables, indicating the probable number of days per month that tanks and other vehicles can be expected to move across country or off roads in the different types of soils in the area.

b. Crossing Sites.--The data on the geological and topographical nature of the soil is used to determine the best approaches to and exits from the various crossing sites. Selection of the proposed crossing sites involves many additional problems. The trace and width of the river; velocity of the current; nature of the banks and approaches to the banks; and location and size of bars, islands, dikes, levees, and other obstacles within or adjacent to the river are determined. Other considerations are observation, concealment, and suitability of the riverbed for anchorages for floating bridges and pile driving.

c. Cross Sections.--Additional detailed geological cross sections and reports on the heights and nature of the banks are prepared. These cross sections are especially useful for determining suitable locations for driving piles for the construction of fixed bridges.

d. Bridging Equipment.--To assist in estimating the bridging requirements for tactical bridging equipment, maps are prepared giving the prevailing widths of the river and of streams in the area adjacent to and beyond the river. The width of the water gap at or near roads is used to determine the amount of bridging equipment needed.

e. Existing Bridges.--Reports are prepared giving the location, load capacity, and a detailed description of the spans and approaches of every existing bridge in the area.

6204. DETERMINATION OF RIVER CHARACTERISTICS

Principal river characteristics which are determined are depicted in figure 49.

a. River Depth.--Field expedients, such as measured poles or weighted ropes, are generally required to determine river depth. Depth readings are normally taken every 3 meters. Even a sluggish stream or river may become a torrent in a few hours or minutes as a result of sudden heavy rainfall. This is more likely in tropical and arid regions. After bridges are constructed, depths and currents are checked at frequent intervals to provide warning of such changes. Additional factors which require consideration are rivers that may be influenced by ocean tides in direction and velocity or by locks and dams under enemy control located upstream from the crossing point that may be emptied in order to disrupt the river crossing.

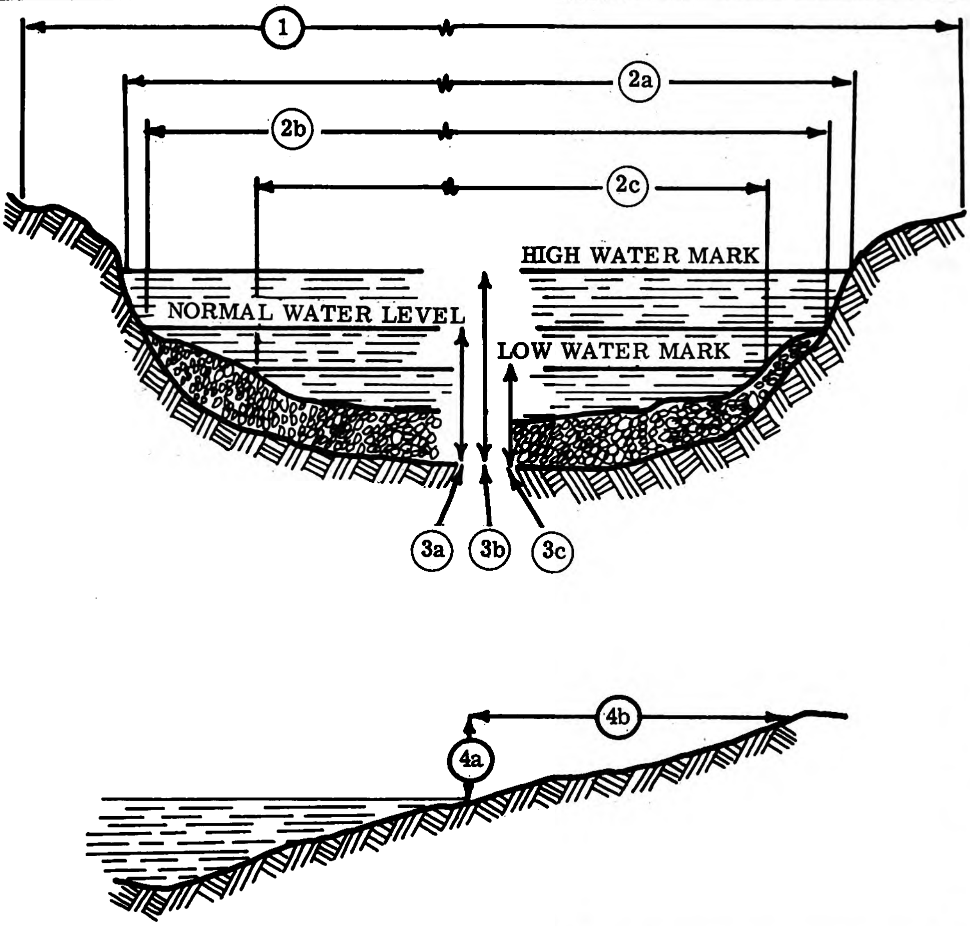
b. River Width.--River width may be determined using a compass, surveying instrument, or tape. (See fig. 50.)

(1) Compass.--From a point on the near shore and close to the water's edge, the azimuth to a point on the opposite shore is determined and recorded. Another point is established on the near shore from which the azimuth to the same point on the far shore is 45 degrees (800 mils) at variance with the previously recorded azimuth. The distance between the two points on the near shore is measured. This distance is equal to the distance across the stream.

(2) Surveying Instrument.--Using transit, aiming circle, azimuth indicator, or alidade, the angle between two points a known distance apart on the near shore and a third point directly across the river from one of these points is measured. The distance across the stream is computed using trigonometric relationships.

(3) Tape.--Using tape, one member of the reconnaissance team holds an end of a tape on the near shore. Another member of the team crosses to the opposite shore and pulls the tape tight. The length of tape which corresponds to the distance across the stream is then measured.

c. River Velocity.--Current velocities vary in different parts of a river. In general, the current is slower near the shore and swifter in the main channel. The current is slower where the stream is wider. To determine the velocity of a river, a distance is measured along the riverbank. A light object which floats is thrown into the stream, and the time the object requires to float a measured distance is recorded. This process is then repeated. The average time of the tests is then used to determine river velocity. (See fig. 51.)



1. Distance Between Banks
2. River Width
   a. High Water Level
   b. Normal Water Level
   c. Low Water Level
3. Depth of River
   a. Normal Water Level
   b. High Water Level
   c. Low Water Level
4. % of Approach
   a. Approach Elevation
   b. Approach Distance

4 = PERCENT OF APPROACH $\frac{4a}{4b}$

Figure 49.--Standard Dimensional Data for Streams.

6205. UNDERWATER RECONNAISSANCE

Physical reconnaissance and selection of deep water fording sites may be conducted by teams trained for underwater reconnaissance. When the water obstacle is narrow, underwater reconnaissance personnel may enter from the near bank and conduct their reconnaissance by swimming to the far bank.

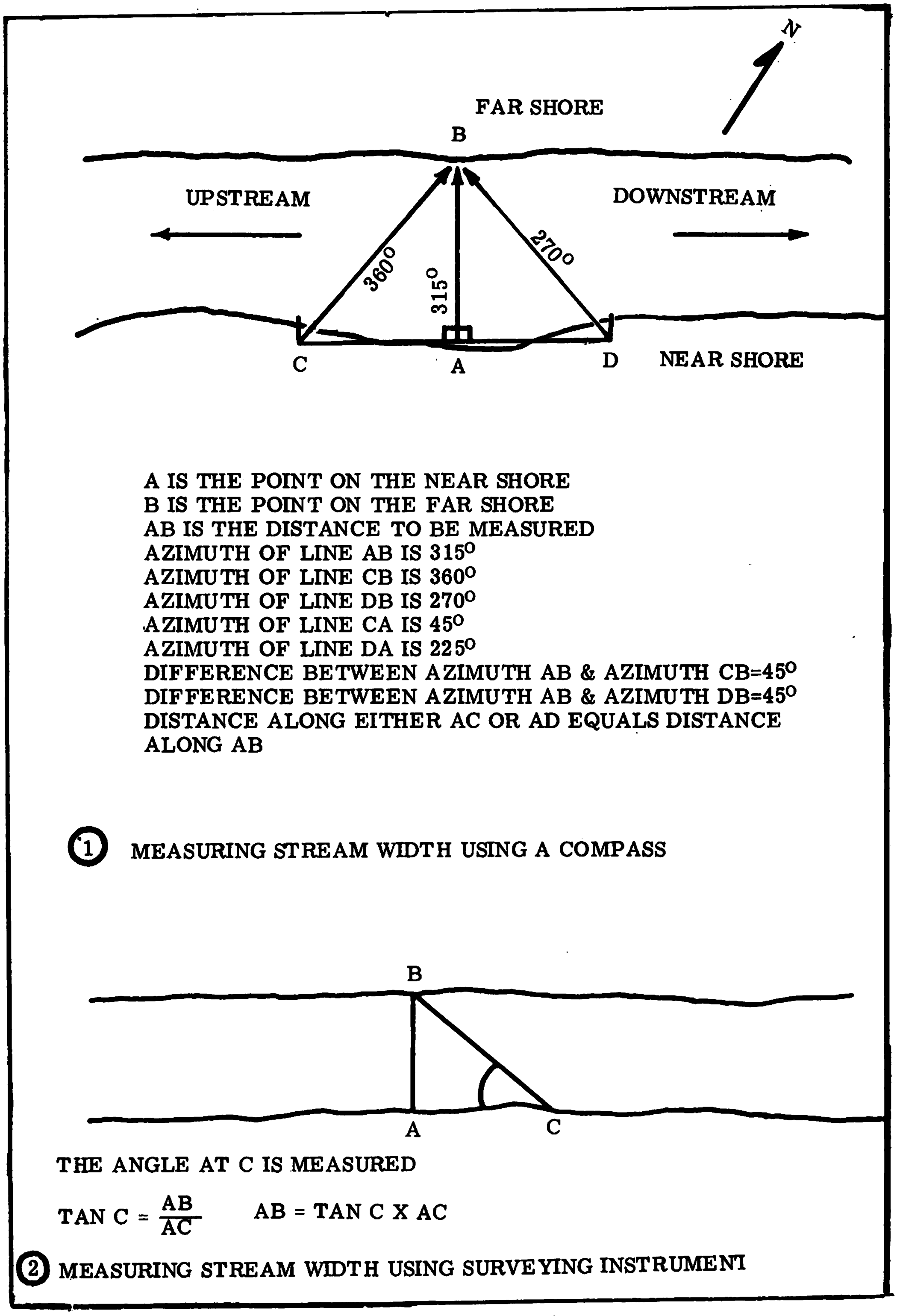


Figure 50.--Methods of Measuring Stream Widths.

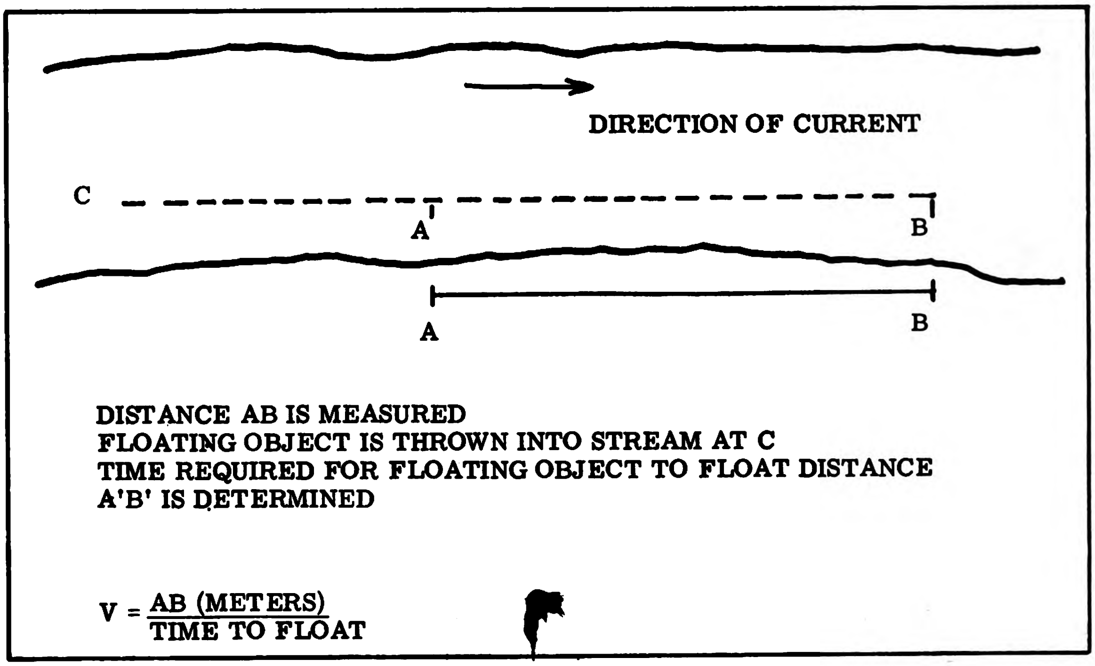


Figure 51.--Method of Determining Stream Velocity.

When trained swimming personnel are not available, amphibious vehicles or reconnaissance boats may be used. These craft remain in the water during reconnaissance and assist swimmers.

a. Maintaining Direction.--To assist underwater reconnaissance teams in maintaining direction, weighted ropes may be placed across the bottom of the river obstacle. Buoys or other floating devices are attached to these ropes to indicate the area of responsibility for each team. When the current is in excess of 1.3 meters per second (4.25 feet per second), underwater reconnaissance personnel have difficulty maintaining a position along the selected line. To assist swimmers, another weighted rope, parallel to the directional rope, may be placed upstream with lateral lines connecting both ropes.

b. Bottom Conditions.--During periods of good visibility and when the water is clear, bottom conditions can be easily determined. Artificial light may be used to assist in reconnoitering the bottom. If the tactical situation permits, searchlights and flares may be employed in addition to waterproof lights used by the swimmers. Under blackout conditions or when the water is murky, reconnaissance is much slower since swimmers must feel their way across the bottom.

c. Current, Water Temperature, and Equipment.--The length of time that underwater personnel can remain in the water depends on the current, water temperature, and equipment. When conducting a reconnaissance in any current, a swimmer expends more energy, tires more easily, and uses his air supply more quickly. In temperatures between 70 degrees and 85 degrees Fahrenheit, divers can work comfortably. Protective covering is usually needed when the water temperature is below 70 degrees Fahrenheit; furthermore, in cold water, sense of touch and ability to work with hands are affected.

6206. RECONNAISSANCE OF BRIDGE SITES

Reconnaissance personnel, other than engineers, may often be required to assist in selecting sites for military bridging. Among the general reconnaissance considerations in selecting military bridging sites are the following:

a. Access Routes.--The bridge site should be located to take maximum advantage of the existing road net on both sides of the river. The reconnaissance includes the location of concealed areas, which are accessible to the main road net, to be used for traffic parks for vehicles waiting their turn to cross the bridge.

b. Approach Roads.--Reconnaissance considers the construction required for bridge approaches at each site. Often, the time required to construct approaches is the controlling factor in the selection of a bridge site. Approaches should be straight and without excessive grade. A turnaround area near the bridge site is needed for moving trucks and semitrailers during the construction phase.

c. Width of Stream.--The width of the stream is determined accurately enough to establish the amount of bridging materials and equipment needed.

d. Banks.--The character and shape of the banks are analyzed in detail, to establish the type of abutments required. Banks should be firm and should not be so high or so steep as to require excessive grading for the approach. Straight stretches of the stream are selected whenever possible because the banks will be subject to less scour. Probe rods should be used in reconnaissance of banks, approaches, and stream bottoms where heavy vehicles are to travel, as the surface of the ground may be crusted and apparently firm to foot reconnaissance, while actually very soft underneath. Conversely, a layer of mud may be deposited over firm materials. The presence of shellfish usually indicates good footing for tracked vehicles, at least.

e. Flow Characteristics.--The velocity of the stream and data on the rise and fall of water are determined. A good bridge site is one where the current is steady, parallel to the bank, and slow to moderate.

f. River Bottom.--The character of the river bottom is noted so the type of support and footings can be determined.

g. Profile.--In order to determine the heights of bridge supports, an accurate cross section of the defile should be made.

h. Local Materials.--The reconnaissance determines the nearest source of materials that can be used in construction. Sources include standing timber and nearby demolished buildings or bridges.

6207. BRIDGE REPORTS (BRIGREP)

Limited bridge information, reported as a result of bridge reconnaissance, includes those elements necessary for planning and conducting normal vehicular movement. These elements are serial number of the bridge, geographic location, military load classification, overall length and width of traveled way, overhead clearance, and available bypasses. Limited bridge information is recorded on maps or overlays by means of bridge

BRIGREP

(STANAG 2096)

1. First Bridge of Report (bridge serial number).

ALPHA	Map sheet(s).
BRAVO	Date and time information was collected.
CHARLIE	Location (UTM grid reference).
DELTA	Type of bridge. (Symbols explained in par. 2-19 of STANAG 2096 may be used. Additional information such as number of spans, overall length, etc., may also be reported if required.)
ECHO	Classification ___ (single flow traffic).
FOXTROT	Classification ___ (double flow traffic).
GOLF	Physical condition of bridge.
HOTEL	Minimum width of traveled way.
INDIA	Overhead clearance.
JULIET	Bypasses.
KILO	Other significant information.

2., 3., etc. Other reconnoitered bridges to be included within the same report.

Figure 52.--Bridge Report Format.

reconnaissance symbols. To provide for standardization in reporting bridge information, the format depicted in figure 52 is employed. The originator reports only those parts of the format which are applicable or for which information is available. However, each item of the report is annotated with the appropriate letter designation from the format to establish the category of information. Each message is preceded by the term BRIGREP, or identifying codeword.

6208. FORD RECONNAISSANCE

A ford is a location where the physical characteristics of the current, bottom, and approaches permit the passage of personnel and/or vehicles and other equipment whose suspension systems remain on contact with the bottom. Particular caution should be paid to those streams and rivers that may be affected by tidal conditions. Trafficability characteristics of fords are summarized in figure 53. Limited ford information is recorded on maps or overlays by means of symbols to provide standardization in reporting essential ford reconnaissance information; the format depicted in figure 54 is employed.

a. Ford Reports.--The originator completes only those parts of the format which are applicable or for which information is available. However, each item of the report is annotated with the appropriate letter designation from the format, to establish the category of information. Each message is preceded by the term FORDREP, or identifying codeword.

TYPE OF TRAFFIC	FORDABLE DEPTH m*	MINIMUM WIDTH m	TYPE OF BOTTOM	MAXIMUM DESIRABLE SLOPE ON APPROACHES**
Foot	1	1= (single file) 2= (column of 3's)	Firm enough to prevent sinking	1:1
Trucks and truck-drawn artillery	.6	3.6		3:1
Medium tanks	.6 to 1.2	4.2	Firm and smooth	2:1
Heavy tanks	1.2 to 1.8	4.2		2:1

*Moderate current.
**Based on hard, dry surface. If wet and slippery, slope must be less.

Figure 53.--Trafficability of Fords.

FORDREP

1. First Ford in Report (ford serial number).

ALPHA	Map sheet(s).
BRAVO	Date and time information was collected.
CHARLIE	Location (UTM grid coordinates and ford type.)
DELTA	Minimum width.
ECHO	Maximum depth.
FOXTROT	Stream velocity.
GOLF	Type of bottom.
HOTEL	Maximum percent of slope on bank exits and entrances.
INDIA	Military load classification.
JULIET	Other information.

2., 3., etc. Other fords to be included in the same report.

Figure 54.--Ford Report Format.

b. Photographs.--Whenever a ford is reconnoitered, it is photographed, if possible. Photographs should show the banks, the approaches, and the stream/river in one view. Whenever practicable, the photograph is taken while a military vehicle is crossing, to give an indication of the water depth and the location of the ford.

c. Bridge Signs.--Instructions for fording are indicated by standard bridge signs. A circular bridge classification sign is employed if the ford is classified as to load-bearing capacity. In addition, rectangular signs are employed to indicate crossing data such as maximum permissible speeds, reminders of wet brakes, depth of ford, etc. Provisions are also made to indicate the trace of the ford across the water barrier. Marking may be accomplished by poles protruding above the water or by ropes supported by buoys. Consideration is also given to marking the ford under conditions of limited visibility. Shielded electric lamps may be used in a manner similar to that prescribed for marking lanes through minefields.

6209. FERRIES AND RAFTING SITES

a. General.--Reconnaissance personnel may be required to locate and report suitable sites for military rafting or ferrying operations. A ferry site is a place or passage where traffic and cargo are conveyed across a river, or other water barrier, by a floating vehicle. Suitable ferry sites vary widely in physical appearance and capacity, depending upon the width, depth, current, and the characteristics of the traffic to be moved. Propulsion of ferries may be by oars, cable and pulley, poles, stream current, engines, or helicopter tow. Construction of military ferries varies widely from expedient rafts to large vessels. Basically, there are two types of military ferries--the trail ferry and the flying ferry.

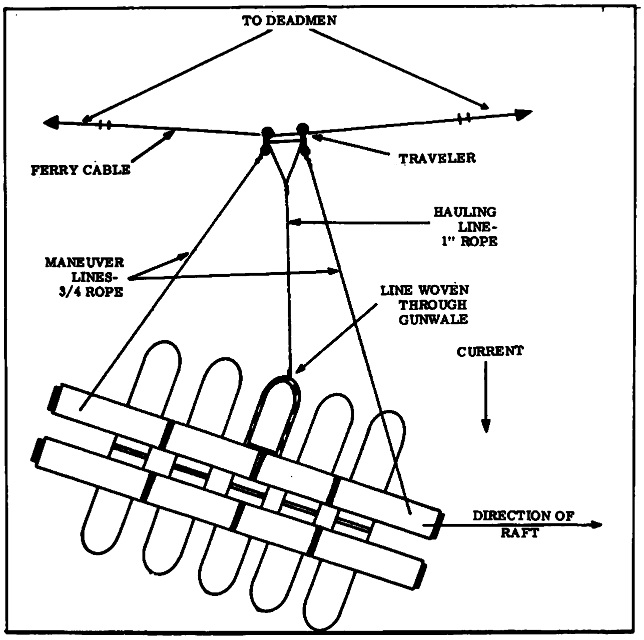


Figure 55.--Trail Ferry.

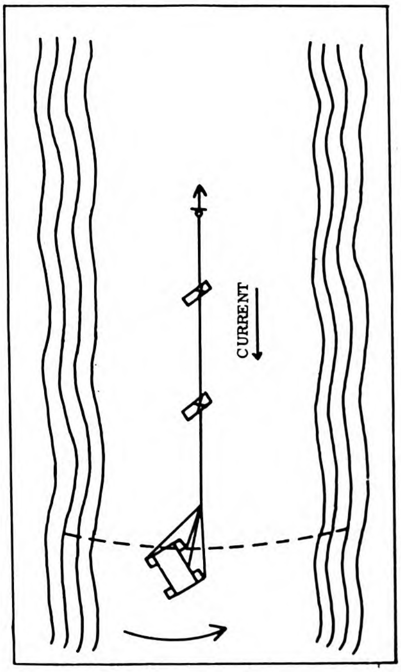


Figure 56.--Flying Ferry.

(1) Trail Ferry.--A trail ferry consists of a raft, connected to a ferry cable stretched across the stream and anchored on each bank. Trail ferries are designed to be current-propelled, but other means of propulsion may be used when stream velocities are too low. (See fig. 55.)

(2) Flying Ferry.--A flying ferry is a current-operated ferry held in the stream by an anchor well upstream from the crossing site. As the ferry moves from shore to shore, it describes an arc with the anchor at the center. (See fig. 56.)

b. Site Evaluation.--Reconnaissance personnel analyze potential sites in terms of the following characteristics which are highly desirable for rafting and ferry operations:

(1) Current velocity between 0 and 1.5 meters per second.

(2) Banks which permit loading without a great deal of preparation; i.e., the banks are firm and about the height of the raft.

(3) Approaches which permit easy access and egress.

(4) Strong natural holdfasts; e.g., trees for securing rafts alongside the bank, etc.

(5) No shoals, sandbars, or snags which interfere with operations.

FERRYSITEREP

1. First Ferry Site in Report (ferry serial number).

ALPHA	Map sheet(s).
BRAVO	Date and time information was collected.
CHARLIE	Location (UTM grid reference).
DELTA	Military load classification of approaches.
ECHO	Possibilities for concealment or cover.
FOXTROT	Width of water obstacle.
GOLF	Depth of water at the banks to include tidal information.
HOTEL	Stream velocity.
INDIA	Slope on bank approaches and bank conditions.
JULIET	Parking areas for road and water transport.
KILO	Additional information such as maximum number of rafts the site can accommodate, work required in man-hours for preparation, and existing stream crossing equipment.

2., 3., etc. Other ferry sites to be included in the same report.

Figure 57.--Ferry Site Report Format.

(6) Sites cleared of obstacles immediately downstream.

(7) Sites clear of mines and boobytraps.

(8) Sufficient depth to prevent grounding the raft or ferry during loading and unloading operations or when crossing.

c. Reporting.--Limited ferry information is recorded on maps or overlays by means of symbols. To provide for standardization in reporting ferry site reconnaissance data, the format shown in figure 57 is employed. The originator completes only those parts of the format which are applicable, or for which information is available. However, each item of the report is annotated with the appropriate letter designation from the format, to establish the category of information. Each message is preceded by the term FERRYSITEREP OR identifying codeword. Photographs are taken of all ferry sites reconnoitered. These photographs include the ferry slips, the ferryboats, and the approach routes. If the ferryboats are not self-propelled, the photographs should include auxiliary equipment such as cables, towers, and winches.

Section III. PLANNING

6301. GENERAL

Planning for a river crossing occurs relatively early in an amphibious operation. It is initiated at the start of the amphibious planning cycle and is effected concurrently, to ensure that the landing force possesses the means and capabilities to overcome the river obstacle. Planning for the river crossing has two aspects--tactical and technical. Technical considerations are subordinate to tactical considerations. (See fig. 58.) The best locations for a river-crossing operation from a technical point of view are not always tactically suitable. If the terrain permits the advance of assault elements of the landing force to and beyond a given point on a river line, it is usually possible to install a bridge that will meet the provisions of the tactical plan. Only in rare instances will technical difficulties be of such proportions that they will preclude the use of an otherwise desirable tactical plan. Planning is characterized by close liaison between all headquarters involved in the crossing. Plans are developed in as much detail as possible, and all technical data about the river and the approaches to it are assembled. The plans are flexible so that later changes, dictated by detailed reconnaissance and intelligence or unexpected events, can be made without serious consequence. When elements of the landing force reach a river obstacle and find bridges in usable condition, plans are modified to meet the demands of a hasty crossing.

6302. RESPONSIBILITY FOR PLANNING A RIVER CROSSING

Planning of a river-crossing operation incidental to the conduct of an amphibious operation is the responsibility of the commander landing force. It requires detailed coordination with, and approval of, the CATF to ensure the availability of required bridging equipage and to ensure adequate fire support for the projected operation. Within the landing force, planning for projected river-crossing operations is conducted concurrently at all levels. The primary responsibility for planning a river crossing is retained by the commander controlling the troops, equipment, and other means required to successfully overcome the river obstacle. For rivers of minor tactical importance which cannot be crossed using division resources, the division commander requests additional resources from the commander landing

TECHNICAL	TACTICAL
Width	Mission
Depth	Enemy situation
Velocity	Road net
Banks	Cover and concealment
Obstacles (in the river)	Observation and fields of fire
Approaches	Obstacles (other than river)
Equipment park locations	Own situation
Availability of crossing equipment	Training and experience of troops

Figure 58.--Planning Considerations.

force and may employ them directly or further attach them under the control of a task force commander. When the required troops, equipment, and other means are delegated to subordinate commands, the overall control and primary responsibility for planning pass with it. For primary water obstacles of major tactical importance, the overall control and tactical responsibility for planning are normally retained by landing force commanders. For major water obstacles of great strategic importance, where large quantities of heavy bridging and other equipment (in excess of that which is normally available to a landing force) are required, preliminary planning and resource procurement are done by the theater or area commander.

6303. PLANNING PHASES

The planning for a deliberate river crossing is normally divided into preliminary, initial, and general planning phases.

a. Preliminary Phase.--The preliminary phase is executed prior to the receipt of a directive from higher headquarters.

b. Initial Planning Phase.--The initial planning phase is executed after receipt of the directive and is based on the commander's concept.

c. General Planning Phase.--The general planning phase commences with the commander's decision and includes:

(1) Preparation of the first draft of the operation plan and annexes and submission for approval.

(2) Publication of the final approved plan and issuance of necessary orders.

(3) Assistance to lower echelons in the completion and execution of their plans.

6304. TECHNIQUE OF PLANNING

A successful river-crossing operation is the outgrowth of continuous planning which is consistent with changing conditions and which takes into account the latest technical information.

a. Preliminary Planning.--Preliminary planning is best developed by planning backwards from the objectives in the following sequence:

(1) Determine main objective areas (obtained from the plan for major crossings).

(2) Determine area required in bridgehead for various phases.

(3) Estimate strength and type of landing force elements required to hold bridgehead.

(4) Estimate amount of time required to seize bridgehead objectives on various phase lines.

(5) Consider seizure of intermediate objectives in reverse order.

(6) Estimate strength and allocation of assault troops.

(7) Determine most advantageous crossing areas.

(8) Determine amounts and types of crossing equipment.

(9) Determine engineers and other support requirements.

(10) Estimate construction time.

(11) Determine special training necessary.

(12) Determine logistic requirements for each phase.

b. Initial Planning.--The following information is included as a minimum in all tentative plans:

(1) Tentative crossing sites.

(2) Tentative time and formation for crossing.

(3) Plans for coordination of command.

(4) Tentative plans for deception.

(5) Probable objectives on far side of the river; designation of landing force elements to capture them; mission of supporting arms and services.

(6) Tentative allocation of crossing equipment.

(7) Approximate location of staging and assembly areas; responsibilities for protection against air, airborne, and waterborne attack.

(8) Composition of the leading troops and reconnaissance parties; limitations to be imposed on forward reconnaissance.

(9) Traffic control arrangements.

(10) Movement of special crossing troops and equipment into position.

(11) Communications.

(12) Special missions for leading landing force elements upon reaching the river.

(13) Screening and control of civilian population.

(14) Air support.

(15) Plans for training and rehearsal of the assault force.

(16) Tentative plans for the use of smoke.

(17) Logistic support during all phases of the operation.

c. General Planning.--The instruction and other information to be included in the final detailed plans depend upon the level of the planning

headquarters within the landing force. However, the detailed plans of this phase include all aspects and data necessary to ensure performance of all of the responsibilities of the planning headquarters. Final plans are complete and orders issued sufficiently early to allow all lower echelons time to complete their plans and preparations.

6305. ENGINEER PLANNING

The landing force engineer, who is normally responsible for overall control of engineer elements, prepares a plan for the employment of engineer units. This plan is based on reconnaissance and planning performed by, and in conjunction with lower, adjacent, and higher headquarters, and includes the designation of specific areas for the installation of bridges and ferries, assignment of engineer missions, allotment of crossing equipment, disposition of engineer units, traffic control arrangements, plans for the installation of protective devices, plans for the removal of mines and obstacles, and plans for rehearsal and training of personnel. For operations where the crossing means are attached to a division commander, the overall control of engineer units is also delegated. Detailed plans are also prepared by the various engineer units. Normally, detailed plans formulated by engineer elements are not completed until after a final ground reconnaissance has been made of the areas adjacent to the river. Such a ground reconnaissance may not be possible, in extreme cases, until after the assault crossing has begun. In this event, large scale aerial photos are invaluable. Plans prepared by engineer elements provide for the following, as a minimum:

a. Determination of the amount and the exact nature of all work to be performed. This is taken primarily from the ground reconnaissance reports and includes precise site location and length of bridges, work required to prepare assembly sites and abutments, approach road work, and work required to install anchorage systems.

b. Determination of the amount of bridging and other supplies and materiels to be employed and plans for delivery to assembly sites. This total includes a reasonable amount of bridging and supplies to be held in reserve at the site, for immediate replacement of any part or section damaged as a result of enemy action or accident. The location and plan of delivery of additional bridging materials, which are needed for the maintenance of the bridge, are also included in the overall plan.

c. Organization of supporting and attached troops into working parties, and assignment of specific tasks. Normally, bridge companies are given such specialized tasks as installation of the anchorage system, operation of power boats, incorporation of raft sections into the bridge proper, and installation of trestles. Elements of the engineer battalion are employed on the more common engineer tasks requiring less specialized training such as demolitions and clearing to prepare assembly sites, approach and abutment work, and operation of raft section-assembly sites. Additional troops are attached to engineer units, in sufficient numbers, to ensure completion of all work in the proper sequence.

d. Allocation of assigned equipment to specific tasks. Normally, organic equipment of the bridge company and the engineer company, when combined, is sufficient to handle all assembly problems. Necessary equipment in excess of that organically available is requested as early as possible.

e. An operations schedule specifying the sequence and timing for the completion of specific engineer tasks.

f. Provisions for local security. Normally, local protection of engineer working parties is provided by division or landing force. However, provision for required local security measures is incorporated in the detailed plan.

g. Miscellaneous administrative plans: traffic plan, dispersal plan, communication plan, and bivouac plan.

6306. SCHEME OF MANEUVER

The first step in the development of a crossing plan is the development of a scheme of maneuver. The basic approach to the development of a scheme of maneuver results in backward planning. In doing this, the operation is initially considered without the river line and the restrictions it imposes upon the problem. The bridgehead line is assigned by the commander landing force along with objectives to be seized to secure that line. Possible avenues of approach by both ground and air means are studied. Avenues of approach are determined. Intermediate objectives along avenues of approach, which are necessary to control and facilitate the assault, are selected and marked. Next, enemy dispositions, weather, terrain, and routes of communication, as they affect each of these avenues of approach, are considered. From this estimate, a tentative scheme of maneuver on the far shore is selected. This indicates how the landing force would prefer to advance on the far shore if no river restrictions entered into the situation.

6307. EXTENT OF THE BRIDGEHEAD

Concurrent with the development of his scheme of maneuver, the commander considers the extent of the bridgehead on the far shore. In many ways, the planning considerations encountered during this phase parallel those in planning to secure the beachhead in an amphibious operation. However, there is one major difference. The beachhead usually includes the force objectives and the amphibious operation may be terminated when the beachhead has been secured. In a river crossing, however, it would be an unusual coincidence if the force objectives were within the bridgehead. The crossing is a means to continue the attack and not an end in itself. Thus, the primary considerations in determining the extent of the bridgehead are:

a. Sufficient depth to permit reorganization of the force without undue congestion, but not so great as to hamper the rapid linkup of surface assault elements with helicopterborne assault elements. If objectives are too far beyond the far shore, helicopterborne elements may become isolated and cut off. This is particularly true if the enemy has a mechanized capability. In such a situation, instead of the orderly linkup and continuation of the attack, the operation may become a rescue operation.

b. Sufficient width to provide adequate space and crossing sites.

c. Defensibility, considering both terrain and room for maneuver.

d. Orientation to favor continuation of the attack.

6308. SIZE OF THE CROSSING FRONT

In the preparation of the crossing plan, the commander landing force determines whether to cross on a broad or narrow front. Normally, it is more desirable to attack on a broad, rather than a narrow front. However, the final decision is based on an estimate which considers the number of crossing sites, the availability of engineer support, and the enemy disposition and capabilities. In this process, the advantages and disadvantages of each type of crossing are considered.

a. Broad Front Attack

(1) Advantages.--The advantages of a broad front attack are that such an attack:

(a) Lessens the vulnerability of landing force elements to enemy fires.

(b) Initially conceals the landing force's main effort.

(c) May develop weak points in the enemy's defenses.

(d) Forces the enemy to disperse to meet all of the attacks.

(e) Gets more troops across the river faster.

(f) Provides greater opportunity for maneuver in exploiting success.

(g) Lessens vulnerability to mass destruction weapons.

(2) Disadvantages.--The disadvantages of a broad front attack are that it:

(a) Disperses the effort of landing force tactical elements and their supporting fires.

(b) Increases the difficulties of maintaining tactical control.

(c) Increases the requirement for crossing equipment and specially trained engineer personnel.

b. Narrow Front Attack

(1) Advantages.--The advantages of a narrow front attack are that such an attack:

(a) Permits supporting fires to be intensified.

(b) Simplifies tactical control.

(c) Aims at gaining surprise by the speed and power of the attack.

(d) Decreases the requirement for crossing equipment and specially trained engineer personnel.

(2) Disadvantages.--The disadvantages of a narrow front attack are that such an attack:

(a) Permits the enemy to concentrate his fires.

(b) Indicates the main effort of the landing force quicker, thus permitting the enemy to concentrate his mobile reserve forces.

(c) Provides a better target for mass destruction weapons.

6309. CROSSING SITE SELECTION

a. General.--In the selection of crossing fronts, crossing areas, and crossing sites, both the technical and tactical requirements are considered and evaluated. Terrain on the far shore in the vicinity of all crossing sites should enhance the local security of the site. Conflicts between tactical and technical requirements are normal. The commander weighs all the factors involved and arrives at the best overall solution.

b. Evaluation of Crossing Sites.--Amphibious vehicle officers should be called on for their evaluation of crossing sites. It should be noted that many sites might be rejected offhandedly considering the banks are too high at the exit points, when these might be capable of almost instantaneous preparation by firing HE rounds, with delay fuzing, into the bank. This technique is usable on banks up to 10 feet high, dependent on their composition. It may afford the opportunity to attain surprise in a hasty crossing at a point less likely to be heavily defended. (See fig 59.)

SITE APPROACHES CROSSING SITES	CURRENT WIDTH DEPTH	BANKS	OBSTRUCTIONS	RELATIVE MERIT	REMARKS
1. None directly to site	3.3mps 50m 4.2m	Firm, low	Rocky	Poor	Ferry site on right flank.
2. None directly to site.	2.7mps 70m 4.2m	Firm, low	Rocky	Poor	Pond and canal block movement to south.
3. All weather road and several trails near site.	1.9mps	Firm, low	Sand bars (firm)	Good	Built-up area on north side.
4. 2 roads and 2 trails require extension and improvement.	2.4mps 50m 4.7m	Soft, low	Sand bars (firm)	Fair	Ponds and small streams hinder movement to south ferry site at 082369.
5. All weather road and one trail.	3.1mps 70m 4.3m	Firm, moderate	Rocky	Poor	Ferry site on right flank; dominated by high ground on south side.

Figure 59.--Technical Evaluation of Crossing and Bridge Sites.

c. Technical Considerations.--Technical considerations include the use of existing sites which are adaptable to construction or improvement of fords, including use of piling on which to construct "underwater bridges" or to reconstruct overwater bridges.

6310. TIME OF CROSSING

Another basic decision in developing the assault crossing plan concerns the time of crossing. In an amphibious operation, H-hour is the predicted time at which the leading wave touches down on the beach. It could also be the time at which the leading wave of helicopters touches down in the landing zone. In a river-crossing operation, H-hour is the time at which assault elements of the landing force cross the line of departure. In determining the time of crossing; i.e., whether to make a daylight or night crossing, the landing force is confronted with essentially the same considerations it faces in deciding for or against any other night attack. These include the nature of enemy resistance, requirement for and capability of attaining surprise, level of experience and training of assault troops, need for concealment, requirements for control and coordination, natural light conditions, and the need for speed. In general, the capabilities of the landing force's river crossing means favor the daylight crossings in order that their speed may be fully exploited, while maximum control and coordination are achieved. This is particularly true when nuclear fires are to be exploited on the far shore. These considerations are carefully weighed against the requirements for secrecy and surprise. However, the skilled use of feints and demonstrations, coupled with the use of screening smoke, can provide the landing force a substantial degree of surprise even in a daylight crossing. When there is early morning haze in the river area, it is well to consider making the approach to the river in darkness, with H-hour at about the beginning of morning nautical twilight. This technique involves many of the advantages of both the daylight and night crossings.

6311. ALLOCATION OF RESOURCES

The process of allocating troops and equipment is identical to that employed in an amphibious operation. It is necessary to ensure the most effective and efficient use of all crossing means and to allocate forces in a manner which places them across the river, in the strength required, and in the proper sequence, to support the scheme of maneuver. (See fig. 60.) The normal Marine Corps planning processes, conventional RLT and BLT organizational structures, and principles of task organization lend themselves to the river-crossing operation.

6312. FIRE SUPPORT

With a scheme of maneuver determined, and the combat units and supporting equipment properly allocated, the employment of available fire support elements is considered. The problem is to obtain the maximum support from the various means available. All fire support, except air support, naval gunfire support, and armored amphibians, is usually from the near bank, until crossing facilities are in operation to permit displacement of weapons to the far bank of the river. Counterbattery and countermortar fires are emphasized in the river crossings. The canalization of elements of the landing force, due to the possible scarcity of crossing sites, could be disastrous unless fire support is available to neutralize enemy artillery and mortar fire. Regardless of whether the assault is made at night or in daylight, detailed fire support plans are made for any deliberate crossing. Normally, fires are controlled on the highest level until the crossing has been effected. In general, fire support is employed as follows:

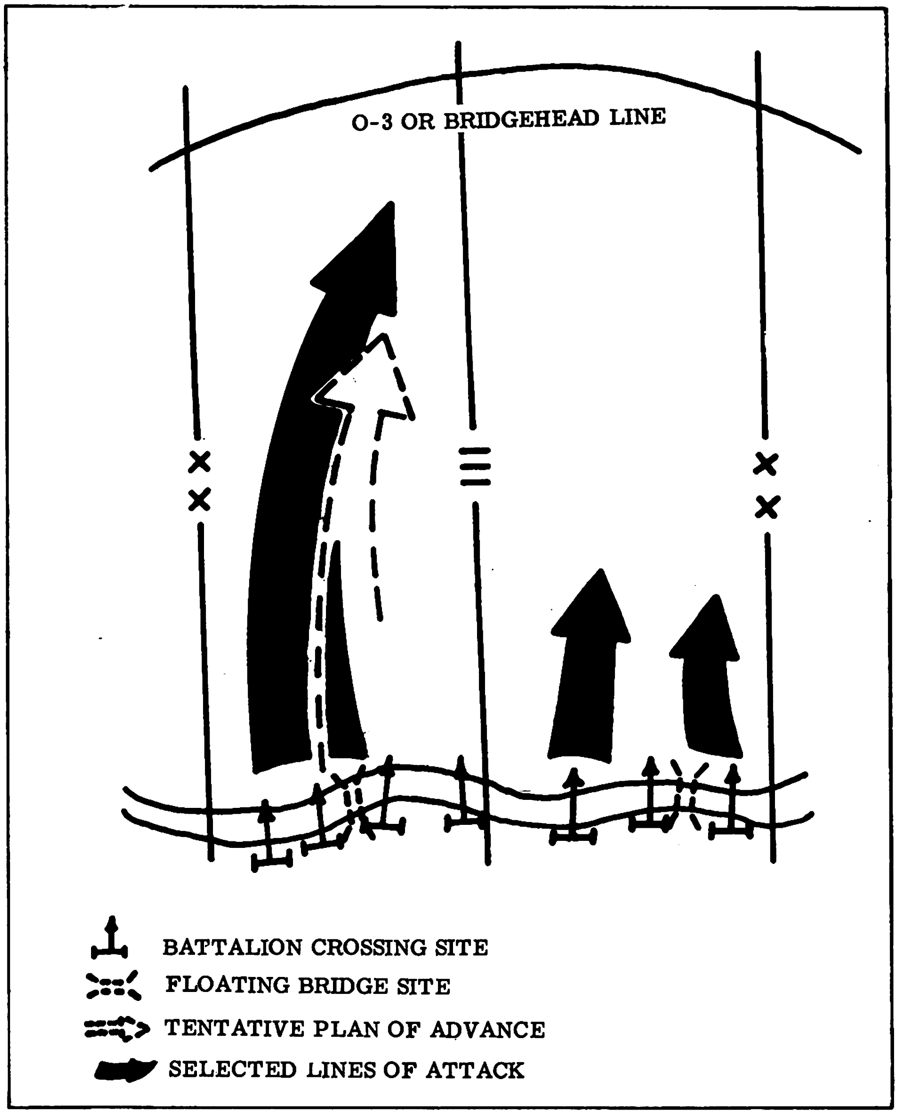


Figure 60.--Scheme of Maneuver.

a. To isolate the area.

b. To neutralize enemy opposition at the crossing site.

c. To prevent enemy artillery and mortar fire on the crossing sites.

d. To protect against air attack.

e. To support secondary or deceptive crossings.

6313. ENGINEER SUPPORT

To provide the necessary engineer support to a Marine division involved in a river-crossing operation, the force attaches to the division, the necessary bridge company sections at the rate of one section for each

floating bridge or two rafts as required. For a detailed discussion of the force bridge company, see section V of this chapter. Bridge company units are normally attached to a force engineer battalion for administrative and operational support. For operational employment of bridging, the host engineer battalion is responsible for assisting in the erection of the bridge.

a. The width of crossing, current, weather, and combat circumstances may preclude the erection of footbridges or the floating bridge. Weather and attendant water conditions may eliminate the ferry as a crossing means.

b. Footbridges and rafts, in a dispersed operation, are erected in a regimental zone and controlled by the commander of an assault RLT. In this instance, the engineers may be either attached to or in direct support of the RLT.

c. The 60-ton floating bridge is rarely controlled by the commander of an assault RLT and is normally erected and controlled by division. When the distance of the division's advance precludes continued control of an installed bridge, force will normally assume control of the bridge.

d. Engineer troops cross the river with assault elements of the landing force. Engineer tasks on the far shore, which are to be accomplished early in the operation, include mine clearance, breaching of obstacles, rehabilitation of egress routes, road construction, and other attendant tasks in support of assault units.

6314. LOGISTIC CONSIDERATIONS IN RIVER-CROSSING OPERATIONS

a. General.--Administrative/logistics plans for a river-crossing operation are developed concurrently with operation plans. These plans are based upon two precepts:

(1) The forward movement of troops and supplies utilizes the road net and the crossing means to their maximum capacity, without providing targets favorable for the enemy's employment of mass destruction weapons.

(2) The forward flow of landing force elements and material proceeds, in the proper sequence and quantity, for maintaining the momentum of the assault, the buildup of the reserve forces on the far shore, and a prompt breakout from the bridgehead.

b. Administrative/Logistics Plan.--To ensure the attainment of these objectives, the administrative/logistics plan is worked out in detail, at all levels, then reviewed and revised at the division level. In its final form, the plan ensures that:

(1) Landing force elements crossing in the early phases of the operation carry, in addition to their basic load, emergency rations and extra supplies which will enable them to overcome temporary delays in operations at the river line. The establishment of small unit supply points at crossing sites assists materially.

(2) Controls are instituted to ensure that established priorities are followed.

(3) Plans are made for furnishing emergency supplies as needed.

(4) Strict traffic control on the roads and bridges and centralized control of the forward movement of all crossing elements will effect full utilization of all crossing means available.

(5) The establishment of supply positions on the far shore and a buildup of supplies is started early to support the breakout from the bridgehead.

6315. SUPPLY PLANNING

Supply plans provide for establishing critical supplies, required by assault troops, on the far bank of the river as soon as the situation permits. Initial supplies are transported across by boats, rafts, amphibious vehicles, and aircraft. As much of these supplies as possible are preloaded on vehicles.

a. Preliminary Planning.--During the early phases of planning, the G-4 ensures that:

(1) Required equipment and supplies are provided to landing force units.

(2) Supply points and distributing points are located well forward and are adequately stocked.

(3) Routes from supply points to assault elements are maintained and alternate routes are provided.

(4) Arrangements for special equipment, to include training in the operations and maintenance of the equipment, are made.

b. Actions During the Execution of a River Crossing.--During the assault phase, the G-4 keeps in close touch with the logistic and tactical situations. Advantage is taken of any speedup in tactical developments which permits establishment of far shore supply points or storage areas earlier than planned.

c. Scope of Plans.--Plans provide for:

(1) Early establishment of supply storage areas or supply points.

(2) Minimum stock levels adequate to ensure continued operations in case of interruption of traffic crossing the river.

(3) The buildup of stock levels to support further offensive operations.

(4) Critical supply situations which occur.

d. Supply Requirements.--Careful estimates of actual supply needs are made. Every load of supplies brought into the bridgehead, in excess of immediate requirements, increases the problem of dispersal and delays the crossing of an equivalent amount of combat personnel or equipment. Oversupply weakens the river-crossing operation.

(1) Class I Supplies.--Individual combat rations issued to each individual best meet the initial requirement for class I supplies. Canteens

should be full at the start of the operation and water purification tablets carried by each man.

(2) Class III Supplies.--The class III supply point in the bridgehead is required early. The size of the point depends upon the number of vehicles employed in exploiting the bridgehead and on requirements for fuel in the later phases of operations. Provision is made for refueling vehicles just prior to crossing the river. This is particularly important when assembly areas are located at a great distance from the river line.

(3) Engineer Class IV Supplies.--A reserve in engineer equipment is necessary to ensure that vital river-crossing means are kept in operation. Reserve stocks of engineer class IV bridging materials are placed in the vicinity of bridge and ferry sites for the maintenance of these crossing means, once they have been assembled. These stocks are dispersed to lessen their vulnerability to hostile nuclear weapons.

(4) Class V Supplies.--Class V requirements are carefully determined before the start of operations. The necessary ammunition for preparatory fires and the assault phase is placed by the weapons so that units cross the river with basic loads intact. Ammunition carriers and resupply vehicles are given a high priority for crossing on ferries and bridges. Ammunition supply points are established as early as possible on the far shore to support the using units.

e. Use of Amphibious Vehicles and Aircraft.--Supply of landing force elements between the time of the initiation of the river assault and the time bridges are open for supply tonnages may present serious problems. A flexible supply plan is required to take care of critical supply situations as they occur. Amphibious vehicles, helicopters, and transport aircraft can be utilized to move supplies, weapons, and equipment across the river before bridges are constructed and at times when bridges may be out or unavailable for movement of supplies. They may also be used to supplement the carrying capacity of the bridges and rafts for high priority items or other special purposes. Arrangements are made to provide for the use of such means when they are available.

6316. TRAFFIC CONTROL PLANNING

a. General.--To prevent congestion at bridge and ferry sites and to make maximum efficient use of crossing means, close control of movement across the river is exercised. The traffic regulation and control plan (G-4) prescribes the measures for controlling the followup units of the landing force. This plan delineates:

(1) Priority lists of personnel and vehicles.

(2) Location of staging and holding areas.

(3) Location of traffic control posts. (See fig. 61.)

b. Communications.--Provision is also made for a communication system connecting staging areas, holding areas, bridge sites, and critical traffic control posts. In establishing the priorities for the crossing of vehicles and personnel, G-4 works closely with G-3. Priorities are assigned

considering the mission, the scheme of maneuver, and the needs of assault echelons for vehicles by type. After the crossing of artillery and tanks, priority is assigned to ammunition vehicles, ambulances, and special engineer equipment. During this period, all traffic is one-way forward, except for ambulances. Ambulances are permitted to return individually, under control of military police stationed at each end of the bridge. Ferries are designated for other return traffic.

c. Main Staging Area.--The main staging area is located at a distance from the river to take advantage of alternate routes to bridge and ferry sites. This location permits diversion of vehicles from one crossing site to another, should it become necessary. Vehicles and convoys move from the main staging area to forward holding areas in accordance with their assigned crossing priorities, so as to minimize congestion on roads to crossing points.

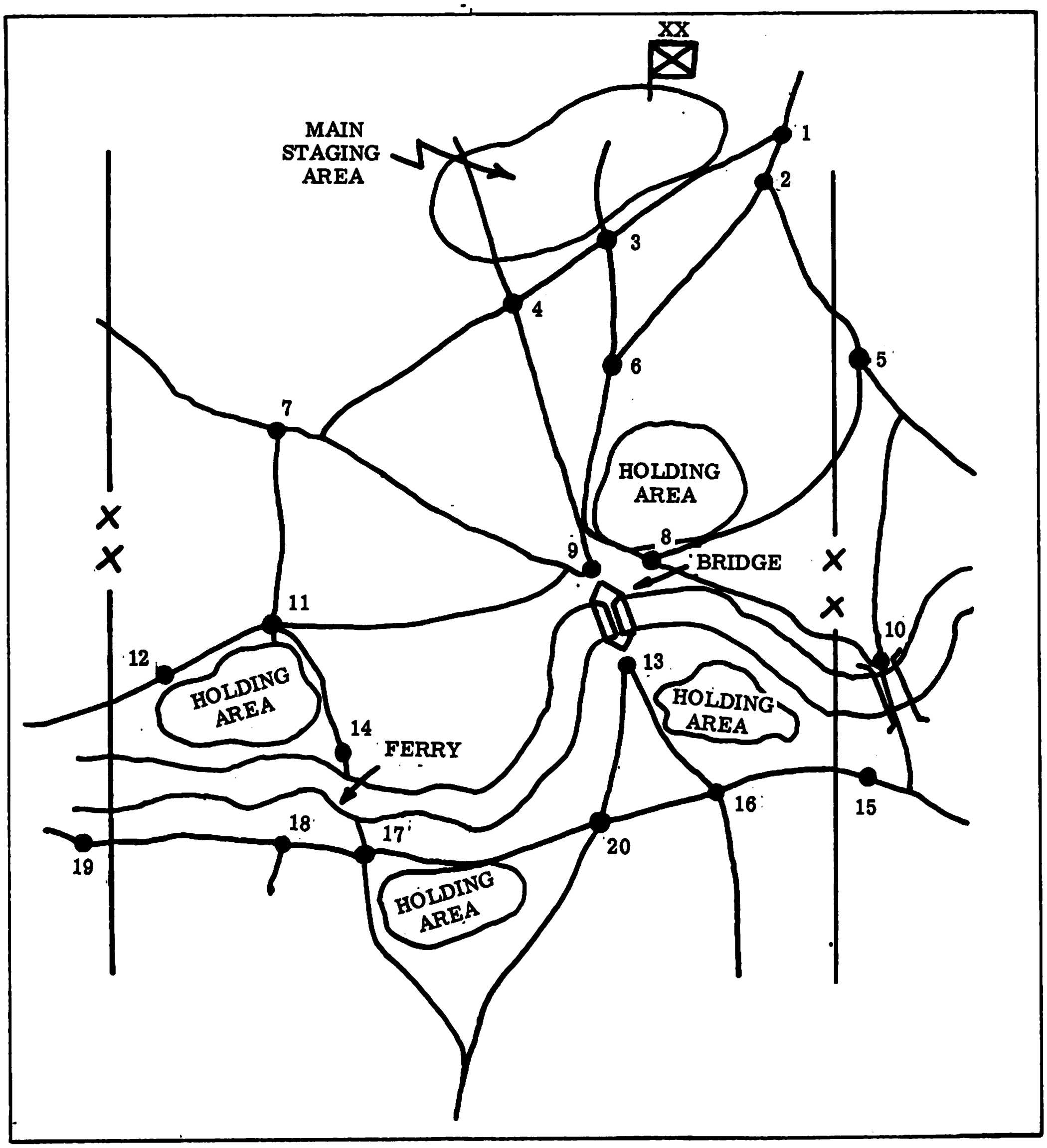


Figure 61.--Traffic Control Posts.

d. Holding Areas.--Holding areas are established at the bridge site and the principal ferry sites on both the near and far bank. Should the use of the bridge or ferry be interrupted, or should any change of plans require a change in priorities of vehicles waiting to cross, vehicles and convoys will be moved off the road into holding areas. Congestion of traffic is avoided on roads in the immediate vicinity of crossing points.

e. Traffic Control Posts.--Traffic control posts are established by division military police. Functions performed by traffic control post personnel in river-crossing operations are the same as for any other operation.

6317. DECEPTION PLANS

In planning a river-crossing operation, every effort is made to disguise the disposition of landing force elements and mislead the enemy. Exploitation of deceptive measures permits the landing force to achieve maximum surprise and may cause the enemy to deploy his forces in a manner that facilitates the operations of the landing force. Deceptive measures of importance in river-crossings are speed, concealment, use of feints and demonstrations, smokescreens, communication security, and careful timing.

a. Speed.--Speed is obtained through prior planning, utilization of helicopters, amphibious vehicles, aircraft, and rapid construction of engineer crossing means.

b. Surprise.--Surprise may be attained by conducting river-crossing operations where the enemy least expects them. The landing force gives serious consideration to all crossing sites, no matter how difficult from a technical standpoint, that may assist the landing force in gaining the element of surprise.

c. Cover and Concealment.--Concealment and camouflage are essential during the assembly of landing force elements and equipment, and preparations for the crossing. Concealed assembly areas, supply storage areas, and equipment and vehicle parks are necessary to achieve surprise. Artillery and other fire support elements occupy concealed positions before the crossing. Registration fire is kept to a minimum or may be prohibited for secrecy. When registration fire is employed, it is not so localized that it reveals the location of planned crossing sites. Concealed locations for all activities are selected as far back from the river as possible, consistent with the mission and the time required to move landing force elements and equipment to the river before H-hour. Movements are normally effected during periods of darkness or reduced visibility. There is a minimum of activity in areas in the vicinity of the river during daylight. Ordinarily, the bulk of the fire support elements move into positions during the night before the crossing. When practicable, smoke is used to screen the preparatory work on the near bank, by means of large area haze-type screens, supplemented as necessary by smokescreens laid on hostile observation posts by mortars, artillery, or aircraft.

d. Demonstrations.--A demonstration is a show of force by landing force elements, designed to confuse and deceive the enemy as to the location of the projected river crossing. Demonstrations, at selected points along the crossing front, assist the landing force in concealing the exact location of the crossing. Among the deceptive measures which may be employed by the landing force are the following:

(1) Movement of landing force elements into logical forward assembly areas or attack positions.

(2) Movement or simulated movement of weapons and equipment into forward areas.

(3) Delivery of nuclear and nonnuclear fires into areas away from the intended crossing sites.

(4) Use of smoke, dummy positions, and equipment.

(5) Employment of special deception units.

(6) Employment of electronic measures.

(7) Employment of landing force air activity in the area of the demonstration.

(8) Demonstration landing of assault elements of the landing force on the far shore by means of helicopter.

(9) Establishment of false radio nets.

(10) Use of sonic devices.

(11) Increased activity of radar.

e. Duplication of Activities.--If the operation is on such a large scale that there must be great activity in the crossing areas on the near bank, the appearance of similar activity may be duplicated at other points along the riverbank. All activity on the near bank and demonstrations on the river are carefully timed to cover the movement of landing force elements and equipment, registration of fires, preparatory near bank reconnaissance, and work for the actual crossing.

f. Feints.--A feint is a limited objective attack designed to confuse the enemy as to the location of the principal crossings. Feints, properly carried out, may force the enemy to disclose his positions. In a large-scale operation, it is feasible to time the feints to make the enemy commit his mobile reserve. This gains time in the critical period of reorganization on the far bank after the assault crossing. This time may be used to prepare against counterattack. Feints are planned, timed, and executed so that if the participating landing force elements gain a decided advantage, immediate steps are taken to reinforce and exploit their success. Landing force elements and equipment making a feint may thereafter not be available for use until the later phases of the crossing operation. Both demonstrations and feints are conducted only on the authority of the commander landing force.

g. Smoke.--Smoke can be used to conceal preparations for the crossing and to assist in the deception plan. Smoke can be produced by smoke generators located on the friendly shore, in boats, in amphibious vehicles, or on the enemy side of the river by smoke pots floated down the river or released from boats; by mortar and artillery shells; and by aircraft.

h. Communication Security.--Communication security, as part of the deception plan, assumes greater importance prior to and during the crossing.

The pattern of communication can be used in various ways for deception. If radio has been used extensively for command and administrative traffic before the crossing, its use is continued during the preparation for the execution of the operation. A dummy communication net may be established. Another deception measure is to establish a pattern of normal radio traffic, followed by a period of radio silence which is designed to lead the enemy into believing that the attack is about to be launched. Such a technique may be employed in conjunction with a planned demonstration or feint. Establishment of such a pattern over a period of several days permits the attack to take place during one of the periods of normal traffic without unduly alerting the enemy. Secure voice radio will be the primary and, in most cases, the only means of communication during the crossing and initial advances on the far bank. Communication plans for the operation must provide for the utilization of other means, if radio operations are hindered during these periods.

i. Timing.--Timing and integration of deceptive measures are of great importance. A detailed schedule for each phase of the deception plan is necessary. To be effective, various measures are employed in combination with other measures to provide realism. For example, the use of noises to simulate tanks moving into an area should be combined with radio activity, dummy tanks, and smell (odor of tanks burning fuel). The initial activity precedes the actual assault by sufficient time to permit enemy reaction. Too much time intervening between the deceptive action and the actual assault assists an alert enemy to determine the nature of the threat and move his forces to oppose the crossing. To accomplish its purpose, the deception plan induces a desired enemy reaction. If this desired reaction is not obtained, the deception effort is wasted.

Section IV. TACTICS AND TECHNIQUES

6401. GENERAL

The execution of a river-crossing operation is considered from four aspects: advance to the river, assembly and preparation for the crossing, assault, and advance on the far bank. In a deliberate river-crossing operation, assault elements of the landing force make an assault crossing employing helicopters and amphibious vehicles. Bridges, ferries, boats, and/or rafts are subsequently employed.

a. Advance to the River.--Every effort is made to approach the river on a broad front, despite limited main routes of communication and terrain difficulties which may impede the advance of assault elements of the landing force. Enemy strongpoints, that may have been bypassed in the initial phases of the amphibious assault, are neutralized before the crossing is attempted. Minefields and obstacles are breached during the advance. The road net in the vicinity of the river line is used as little as possible in order to maintain proper security. Speed in the advance to the river is important, since the enemy may be destroyed, if caught astride the river, and a costly deliberate crossing may be changed into a hasty crossing if bridges are seized intact.

b. Assembly and Preparation for the Crossing.--Normally, all elements of the landing force are assembled in dispersed staging areas, in accordance with their mission in the crossing operation, regardless of their previous functions during the amphibious operation and the advance to the river. The bridging and assault crossing equipment is assembled in engineer equipment parks so that it can be checked, repaired if necessary, and reloaded. Units in staging areas make final preparations and adjustments. Mines and obstacles on the near bank, underwater, and when feasible, on the far bank are removed just before the assault. They are removed by special breaching teams accompanying assault troops. Since engineer resources are greatly taxed during early phases of the operation, specially trained infantry teams may have to undertake the breaching of minor obstacles, particularly those encountered on the far bank.

c. Assault.--The assault force commander determines the sequence in which landing force elements cross the river. The usual sequence is as follows:

(1) The assault echelon moves from dispersed staging areas to assembly areas, where details are checked, final instructions issued, individual equipment and ammunition are inspected, and vehicle and heliteam assignments are rechecked. The assault echelon then moves to the attack position and/or designated landing zones. From these positions, helicopters and amphibious vehicles are loaded with assault elements, who move out directly in the assault.

(2) Engineer elements move through the attack positions to assemble ferries and bridges and perform other designated tasks.

(3) The fire support elements move into assembly areas for crossing or into positions from which they can provide support by fire.

(4) Other crossing elements of the assault force move through concentration or assembly areas at the proper time.

d. Advance on the Far Bank.--The advance on the far bank continues forward of the assigned bridgehead objectives when the tactical and logistical situations are favorable. A successful crossing is promptly and vigorously exploited. A successful crossing in one area facilitates other crossings. Armored units are employed to break out of the bridgehead and strike deep in the enemy rear. Such action tends to relieve enemy pressure on the bridgehead and reduces congestion within the bridgehead.

e. Employment of Bridge and Ferries.--Footbridges are employed as soon as possible in order that succeeding waves and elements of succeeding echelons are not impeded by having to wait for boats, ferries, etc. An infantry support raft ferry service is promptly established at several sites along the crossing front as a means of transporting light vehicles and supplies urgently needed by elements assigned the mission of securing the second objective. Heavy ferries are assembled as soon as possible. They are used to ferry heavy vehicles and tanks before it is feasible to expose heavy bridges. Heavy bridges are assembled as soon as practicable in order to carry large volumes of armored vehicles, engineer equipment, ammunition carriers, heavy weapon carriers, artillery weapons, and other essential vehicular traffic vital to the maintenance and successful exploitation of the bridgehead.

6402. SECURITY

a. Seizing and Holding the Near Bank.--The mission of seizing and holding the near bank is normally assigned to a unit not taking part in the initial assault. This unit thoroughly mops up the near-bank area during the advance to the river to eliminate enemy interference and observation. Arrangements are made for the assault units to reconnoiter the river and prepare near-bank installations. Adequate security is provided along the river and on both flanks of the zone of action to prevent enemy observers and patrols from operating on the near bank. Special precautions are taken to prevent sabotage, particularly of engineer floating equipment, both in supply dumps and on the river. Civilians remaining in the area or coming into the area are carefully screened.

b. Local Defense.--The local defense of both banks of all ferry and bridge sites, concentration and assembly areas, vehicle parks, supply points, and equipment dumps is coordinated under a single command designated to command the crossing site defense, including air defense units. Some artillery is designated to support the defense of the crossing sites in event of enemy counterattack. In general, each unit provides its own local security measures, but units of reserves may be employed in the ground defense plan of crossing sites. Normally, vitally needed engineers are not included in the defense plan of the crossing sites. The landing force elements assigned the mission of crossing site defense are prepared to attack and neutralize enemy stragglers missed during the mopup operation, enemy patrols, and infiltrating forces. The local defense of bridge sites includes protection against floating mines, river craft, and underwater demolition parties. Protective devices are installed by engineer troops. Troops with the mission of ground defense of bridges remain in position until a sufficient force has crossed into the bridgehead to secure the sites against enemy counterattack. Therefore, designated troops guard the bridges as long as there is danger of the bridges being captured or destroyed. Antitank defense of the bridgehead is

so important that the first bridges to be built are sited, if possible, with their approaches on the far bank so situated as to be readily defended against tanks. Antitank weapons and vehicles carrying antitank mines for bridge site defense are given a high priority in crossing the river obstacle.

c. Defense Against Air Attack.--Although they present small targets, bridges are nonetheless susceptible to attack by aircraft. Smoke can be profitably used to protect them from this danger both during and after construction. Concentration and assembly areas, supply points, and equipment parks are also susceptible to air attack and should be properly camouflaged. Antiair warfare operations are planned to protect the construction of bridges and the crossing of troops and vehicles against air attack.

d. Use of Smoke.--Smoke is frequently the only effective means of concealing activities along the riverbank. Skillful use of smoke serves to confuse the enemy and may cause him to shift his fires to unimportant targets and to commit his reserves against other than the main crossing. It is a fundamental principle in the use of area smoke that its control lies with the highest responsible commander directly concerned with the operation. The area covered by the smoke exceeds that actually required for the preparation and assault. Covering too small an area with smoke permits the enemy to mass air and artillery fires on likely crossing sites. The area covered by smoke includes several potential crossing sites, likely assembly sites, and suitable access roads.

6403. EMPLOYMENT OF AMPHIBIOUS VEHICLES

The employment of amphibious vehicles in river-crossing operations is compatible with the general tactical principles delineated in FMFM 9-2, Amphibious Vehicles. Amphibious tractors are used as troop carriers, cargo carriers, or floating bridges in river-crossing operations. Amphibious howitzers are employed in their direct fire role in support of crossings.

a. Vehicular Advantages and Disadvantages.--The same conditions governing employment of amphibious vehicles during the amphibious assault apply during river crossings. A principal advantage of LVT's is their ability to move on land and water without modification. They present a low silhouette while waterborne, protect embarked personnel from small arms fire, and provide a specialized vehicle (LVTC) for purposes of control. Important disadvantages of the vehicles are their slow water speed, limited maneuverability while afloat, noise of operation, and extensive maintenance requirements.

b. Tactical Considerations.--Principal considerations when employing amphibious vehicles in the conduct of river crossings are:

(1) River Width.--Normally, the river's width is the most important consideration in determining a crossing site. Selection of the narrowest point navigable to LVT's lessens the logistical burden, facilitates control, and places the largest number of troops on the opposite shore in the shortest period of time.

(2) Condition of Riverbanks.--The height, slope, and soil composition of riverbanks determine their trafficability for tracked or wheeled vehicles, and influence the selection of crossing sites.

(3) River Velocity.--The slow water speed of amphibious vehicles makes river velocity an important consideration. Vehicle entrance upstream from intended landing sites may be required in order to compensate for strong currents.

(4) Mines, Barriers, and Obstacles.--The existence of mines, barriers, and/or obstacles can impede river crossings by LVT's.

(5) Approaches to Crossing Sites.--Care is exercised to ensure that approaches to crossing sites such as roads, trails, or overland areas will support continued heavy vehicular traffic. Routes are selected to support each unit crossing.

c. Control.--Control measures are completed to ensure that vehicles cross the line of departure as scheduled, maintain proper formation, and use designated approach routes and crossing sites.

(1) Route Markings.--Routes and sites are marked with white or luminescent markers. Guides are used extensively in directing vehicles.

(2) Amphibious Vehicle Formations.--During assault crossings, amphibious vehicles deploy using company, platoon, and final release points. After passing company release points, platoons move forward along approach routes and assume their crossing formation upon reaching the point of final release. Use of release points helps ensure proper coordination and timing, just as control points do in the night attack.

6404. EMPLOYMENT OF HELICOPTERS

The employment of helicopters in river-crossing operations is compatible with the tactical principles delineated in FMFM 3-3, Helicopterborne Operations. Transport helicopters lift the assault elements of the landing force to objectives within the bridgehead. Helicopter landing zones are selected to position assault units within close distance of their objectives or, when possible, on their objectives. Landing zones should provide some cover and concealment and be reasonably free of large obstacles. They should not be open to immediate enemy counterattack during the early stages of the assault crossing. Employment of helicopters in the river-crossing operation conforms to the following general principles:

a. Landing force units requiring troop and/or logistic support from the near bank of the river prepare helicopter landing sites for use in event that bridges or crossing sites are destroyed or rendered unusable.

b. When helicopter availability permits, it is desirable to carry all of the assault troops of the helicopterborne force across the river in one lift. Second lifts are then reserved for the carrying of reserves, light support weapons, and basic combat supplies. If the distances involved are short and the lift cannot be accomplished as above, multiple traffic patterns may be required to properly utilize the number of helicopters involved and to ensure efficient operation. Subsequent logistic buildup is on an on-call basis. Helicopter casualty evacuation from the landing zones is routine. The problems of supply and evacuation, traditionally difficult in this type of operation, are eased by the use of helicopters.

c. To achieve surprise, loading zones are selected which are not susceptible to enemy observation. Careful consideration is given to assembly and loading areas to ensure that they provide cover for troops against ground fire or air attack. Flights are controlled so as to be organized for rapid departure from the loading area. The flights are coordinated with supporting fires and air support to reduce their vulnerability while over enemy terrain. Opportunities for enemy observation of the flight to the objectives in the bridgehead are held to a minimum. When wind conditions are favorable, the use of smoke to shield the helicopters from enemy observation is often desirable. The buildup rate of troops depends upon the size of the landing zone, the distance between loading and unloading zones, and the number of helicopters that can be flown into the bridgehead area at one time.

d. Maintenance and refueling sites are established as close as feasible to the assembly areas.

e. Aerial radiological reconnaissance, aerial reconnaissance, liaison and courier service, traffic regulation and control, propaganda distribution, and aerial wire laying are other missions that may be performed by helicopters in support of troops in the attack of a river line.

6405. TACTICAL AIR OPERATIONS

Tactical air operations are of prime importance in river-crossing operations and are vital elements of the fire support plan. Preplanned and on call missions are directed against heavily fortified targets in the bridgehead area that cannot be engaged by other supporting arms. When air support radar teams or searchlights and flares are available, missions can be effectively pursued during conditions of darkness and low visibility.

a. Air Superiority.--Tactical air operations are principally concerned with maintaining air superiority over crossing sites and assembly areas, and in the bridgehead. Vigorous offensive air support, as well as antiair warfare operations, are conducted to protect assault elements while they are helicopterborne and/or astride the river. These offensive air support operations consist of aggressive efforts to destroy the threat of enemy air attack or reduce it to an acceptable level. Air operations are characterized by attacks on enemy aircraft on the ground, airfields, missile launching sites, supporting installations, aircraft or missile control systems, and other systems that directly contribute to the hostile air effort. An integrated antiair warfare system is established to supplement the offensive air support. This system includes both active and passive measures and integrates air operations and the control of antiair warfare fires. The maintaining of air superiority is carried out concurrently with other air supporting tasks. The priority for missions is determined by the threat to the landing force represented by specific enemy capabilities.

b. Interdiction.--Interdiction assumes special significance in the attack of a river line. Interdiction missions are executed to deny movement of the enemy into the bridgehead area. Specific targets are railroad and highway bridges, railway yards and track, inland waterways, enemy logistic installations, railroad rolling stock, tank and vehicular columns, and troop formations. Care is exercised in the conduct of the interdiction plan to ensure that the plan of the crossing forces is not disclosed. Interdiction missions are planned to deny the enemy free movement into, or within, the objective area prior to the assault crossing by landing force elements.

c. Reconnaissance.--A determined aerial reconnaissance effort contributes materially to the success of a river-crossing operation. All methods of reconnaissance; i.e., visual, photographic, and electronic, are employed as appropriate. Visual reconnaissance attempts to locate enemy movement into, away from, or within the bridgehead. Photographic reconnaissance provides aerial photographs, vertical and oblique, of the crossing sites and the helicopter landing zones. Large scale photos assist in the detailed planning of the river crossing. Photo interpreters examine the photos to locate enemy defensive positions, artillery locations, river characteristics, and road and bridge conditions.

d. Other Air Operations.--Other air operations required to support river crossings are aerial resupply, wire laying, artillery spotting, aerial observation, and liaison and courier service. Such operations are conducted in accordance with the general procedures delineated in FMFM 5-1 Marine Aviation.

6406. EMPLOYMENT OF ARTILLERY

Effective artillery support of a river-crossing operation requires detailed planning and coordination at all echelons. Such planning and coordination conform to the basic principles delineated in FMFM 7-1, Fire Support Coordination, and FMFM 7-4, Field Artillery Support.

a. Basic Considerations.--When the initial assault is to be conducted at night, a silent crossing may achieve surprise; however, a fire plan must be prepared so that fires can be delivered on call. In a daylight river crossing, the maximum amount of fire is planned for each phase of the operation. The area involved is isolated by fires, including nuclear and nonnuclear, and toxic and nontoxic chemicals delivered by mortars, artillery, and missiles. Supporting artillery units are assigned specific missions in the zone of the supported assault units. Where the width of the crossing front precludes retaining all of the artillery under centralized control, at least a portion of available artillery is retained in general support of the force. These general support fires may be shifted by the artillery commander as necessitated by the changing situation. The fire support provided to the assault elements seeks to provide:

(1) Neutralization of enemy strongpoints.

(2) Flank protection by fire.

(3) Interdiction of enemy far-bank routes of communication.

(4) Harassment of enemy troop concentration areas.

(5) Disruption of enemy counterattacks.

(6) Engagement of enemy armor.

(7) Destruction of enemy command and observation facilities.

(8) Directional aids by smoke or illuminating shells.

(9) Support of combat deception measures.

(10) Smokescreens.

(11) Required illumination at night.

(12) Flak-suppression fires for close air support and helicopter-borne operations.

(13) Cover for the displacement of direct support artillery units during the river crossing.

(14) Counterfire against enemy infantry and artillery.

b. Conduct of Artillery Operations.--Artillery occupies concealed positions, before the crossing, when it can be done without compromising security. Such measures are necessary to achieve surprise and to mislead the enemy as to the actual crossing site. Registration fire is kept to a minimum or may be prohibited for secrecy. When registration fire is employed, it is not so localized that it will reveal the location of planned crossings. Concealed locations are selected as far back from the river as possible, consistent with the mission and time required to move the artillery unit to the river crossing. There should be a minimum of activity in these areas during daylight hours. Ordinarily, the bulk of the artillery moves into position during the night before the crossing. Whenever practicable, smoke is used to screen the preparatory work on the near bank by means of large area, or haze-type screens, supplemented by smokescreens on hostile observation posts. Artillery can be used to neutralize observation posts and assist in maintaining the large, haze screen.

c. Displacement of the River Crossing.--Artillery units move forward to selected positions from which they can provide supporting fires during the preparatory phase and the assault on the far bank. Artillery units cross the river in accordance with the crossing plan. Primary consideration is given to providing close and continuous support to the assault units. Movement from the position areas is continuous through the crossing sites. The displacement may begin when the first phase objectives have been seized by the assault troops, if position areas are available beyond the far bank of the river. Personnel and equipment move across the river by landing craft and rafts when bridging has not been installed. Helicopterborne artillery units are particularly flexible and can contribute materially to continuous support of the assault elements. General support artillery units are prepared to provide close support for the assaulting troops during the displacement of direct support artillery units. The major part of the artillery crosses the river when it is determined that continuous effective support can be delivered from the new positions. Congestion at the crossing site is avoided, particularly when the enemy posseses a nuclear capability. Helicopter resupply of ammunition may be necessary until adequate bridging has been installed. Centralization of control is reestablished as soon as possible after the river crossing is accomplished.

6407. EMPLOYMENT OF TANKS

The employment of tanks in a river-crossing operation conforms to the standing operation procedures delineated in FMFM 9-1, Tank Employment/Antimechanized Operations.

a. Tanks in a Hasty Crossing.--Whenever possible, tanks take advantage of their speed and mobility to make a hasty river crossing. In such actions, tanks may be employed to:

(1) Seize crossing means (primarily bridges) intact.

(2) Force crossings at fords against lightly or poorly organized defenses.

(3) Force crossings of lightly defended streams with the assistance of infantry and engineers.

b. Tanks in a Deliberate Crossing.--During a deliberate crossing, tanks may be held in general support until a satisfactory bridgehead has been established and means are available for their crossing. Tanks can also be employed in a direct fire role in support of the crossing or with forces performing feints. When performing direct fire missions, a reconnaissance is made to determine the best positions from which tanks can deliver supporting fires. Tanks are brought forward by covered routes to defilade or dug-in positions. Alternate positions are prepared as required. Positive arrangements for control of the fire are made with the units being supported, so that the tank fire may be lifted, shifted, or stopped in a manner similar to that of artillery or mortar fires. Liaison personnel capable of performing this function are sent to the crossing unit. When employed in a direct fire role, tanks are supplied with ammunition in excess of their basic loads so that all tanks, when later employed across the river, will have full loads of ammunition. Tanks move rapidly across the river as soon as means are available for their crossing. Their crossing is effected early in order to stem enemy counterattacks or armored assaults. Once in the bridgehead, tanks are assigned missions to seize deep objectives.

6408. NUCLEAR CONSIDERATIONS

When a river-crossing operation is conducted with or under the threat of nuclear weapons, a wider and deeper bridgehead is required to provide for adequate unit separation and maneuver room for the execution of the attack out of the bridgehead. In this same connection, particular care is taken to ensure continuing the momentum of the attack to secure the bridgehead. The employment of nuclear weapons places much greater emphasis on the crossing means, such as helicopters and LVT's, to exploit the nuclear fires and in the use of dispersed ferries for the crossing of heavy equipment. The requirement for bridges is not eliminated, however, and the planner must plan for the building of enough bridges to ensure the momentum of the attack. With the employment of nuclear weapons, the desirability of executing a hasty crossing is enhanced. A hasty crossing is never based on the seizure of bridges, although every effort is made to capture them intact. In this connection, nuclear weapons may be used to destroy troops defending bridges, while avoiding overpressures that would demolish the bridges.

6409. CHEMICAL CONSIDERATIONS

a. When conducting a river crossing in a chemical environment, the attacking forces may have to move from the dispersed staging areas directly into the attack position, bypassing the assembly area, thus preventing a lucrative target for the enemy's chemical weapons. Assault forces should be prepared to monitor continuously for possible chemical barriers located on the far bank and within the bridgehead.

b. Offensive employment of chemical agents should complement the employment of HE. The creation of an obstacle, using a persistent agent, can be used to assist in isolating a bridgehead, thus impeding an enemy from counterattacking or from reinforcing the bridgehead. A chemical obstacle, as any other obstacle, must be covered by supporting weapons fire and observation.

Section V. FORCE BRIDGE COMPANY

6501. GENERAL

a. Mission.--The primary mission of the force bridge company is to maintain and provide fixed panel and floating bridge equipment to support the heaviest loads in the landing force and to provide technical supervision for the construction of the standard bridges.

b. Organization.--As illustrated in figure 62, the bridge company consists of a company headquarters, a service platoon, and three bridge platoons. It is capable of being task organized to meet the needs of the landing force in river-crossing operations. Each bridge platoon consists of a platoon headquarters and two bridge sections. The platoon's equipment includes one floating 60-ton bridge, one fixed aluminum highway bridge, and two footbridges.

(1) Command and Control.--The company commander performs the staff functions required for planning, direction, and supervision in accomplishing the primary mission.

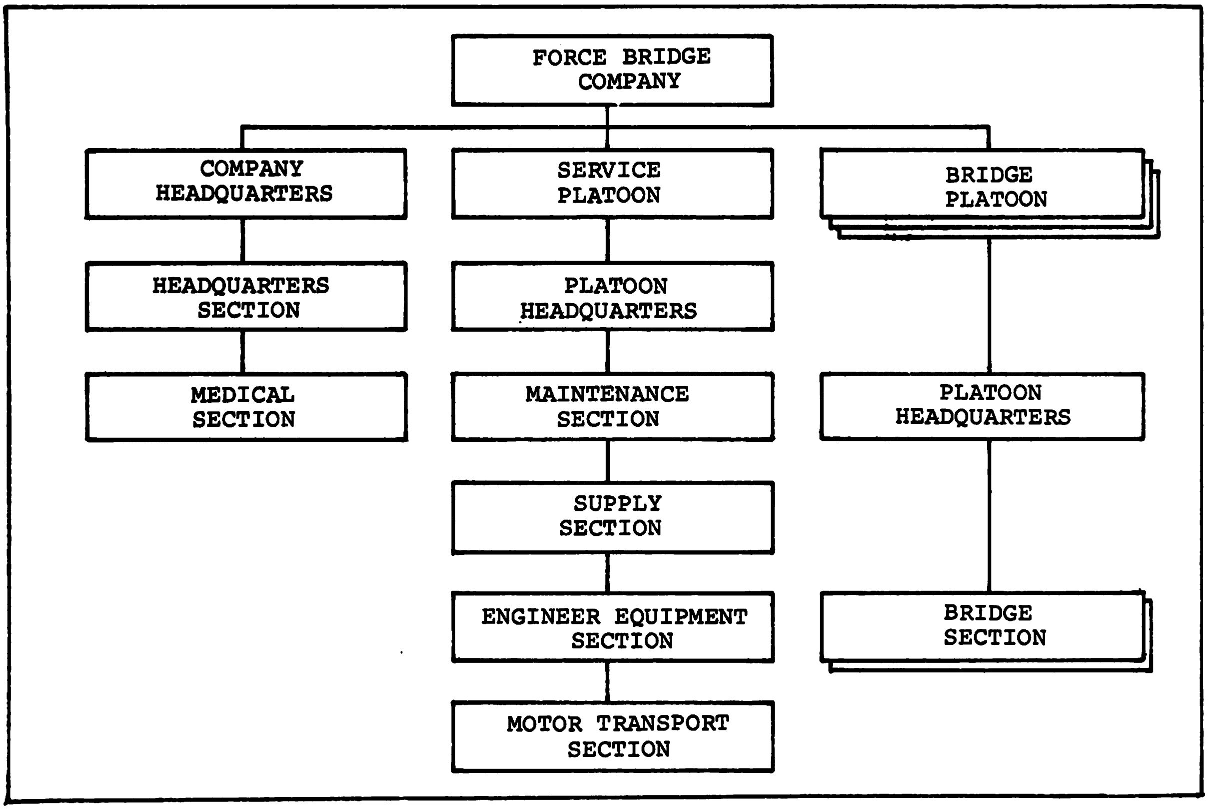


Figure 62.--Force Bridge Company.

(2) Armament.--The bridge company is capable of conducting a limited local defense with individual weapons and machineguns.

(3) Logistics.--The bridge company possesses the following maintenance, medical, transportation, supply, and messing capabilities:

(a) Maintenance.--Capable of first echelon maintenance on organic communications-electronics equipment and organizational (first and second echelon) maintenance on all other materiel.

(b) Medical.--Limited medical support in the form of corpsmen for emergency treatment of casualties.

(c) Transportation.--Transportation means organic to the company consist of command and logistic vehicles. These vehicles are sufficient to accomplish the routine logistic and administrative functions of the company. Fifty percent of the company's bridging equipment can be mobile loaded on its trailers. Prime movers must be provided from external sources to pull the trailers and to transport the balance of the organic bridging.

(d) Supply.--Capable of organic supply functions for the company. The supply section is capable of providing sustained supply support to company elements during combat or garrison operations.

(e) Messing.--The company can provide for its own messing.

c. Concept of Employment.--The bridge company, its platoons, or sections are normally attached to a force or division engineer battalion for operational employment. Bridge erection is the responsibility of the unit to which the bridge unit is attached. Bridge company personnel are responsible for providing technical assistance and supervision during erection of prefabricated bridging, for operation of ferries constructed of floating bridges, and for maintenance of these structures. When the company is attached to a force engineer battalion or elements are attached to the division engineer battalion, the handling and transportation of bridges becomes a responsibility of the unit to which the bridge company is attached.

d. Functions.--The bridge company can perform the following functions:

(1) Provide bridging within the limits of its available equipment.

(2) Maintain and have available three floating bridges, three fixed aluminum highway bridges, and six footbridges.

(a) With one complete floating bridge, it is possible to construct two 60-ton capacity rafts or erect one 60-ton floating bridge, with a maximum length of about 276 feet, or erect short fixed-span bridges using components of the bridge set. These short fixed-span bridges can be rapidly erected in variable lengths and capacities. Under some conditions, short fixed-spans may be partially assembled, and transported and placed in position by helicopter.

(b) The aluminum fixed-panel bridge contains components to construct 210 lineal feet of single truss bridging and ramp equipage for three separate bridges. (See fig. 63.) Maximum span for this bridge to handle class 60 loads for normal crossings is 135 feet for single truss and 195 feet for double truss construction.

(c) The aluminum foot bridge set contains components to erect 315 lineal feet of single treadway floating footbridge or to construct a light vehicle floating bridge with adequate capacity to handle helicopter transportable vehicles.

(3) Provide technical assistance and supervision for the installation of all prefabricated bridging.

(4) Maintain prefabricated bridges after their erection and operate and maintain ferries.

(5) Maintain and provide sufficient trailers to transport 50 percent of the organic bridging.

6502. TRAILER LOADING SYSTEMS

The major items available for transporting standard bridge equipment is the 6-ton, overland capacity, semitrailer with dolly. (See fig. 64.)

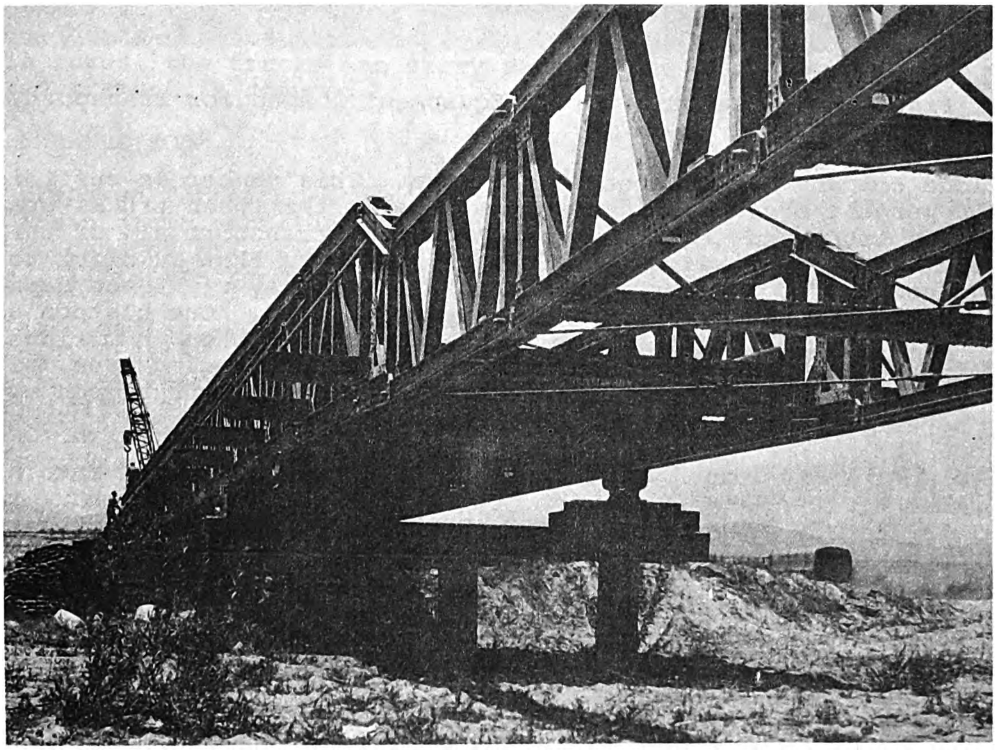


Figure 63.--Aluminum Fixed-Panel Bridge.

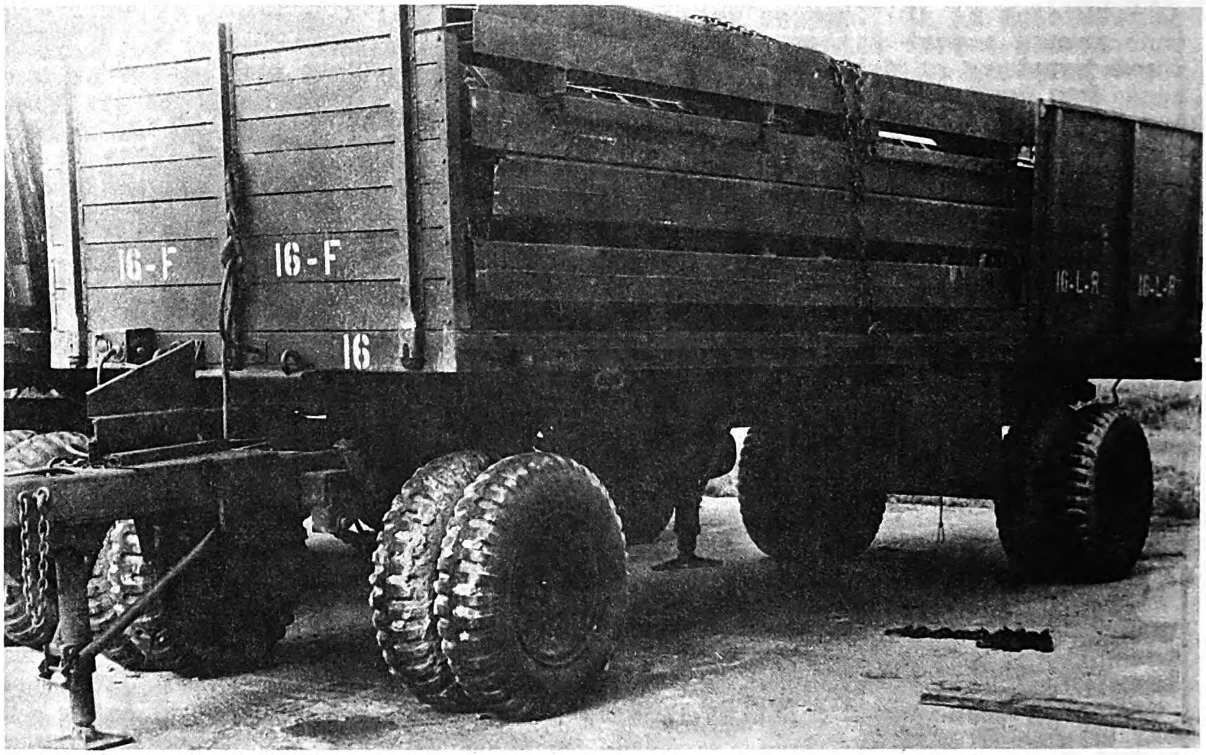


Figure 64.--Standard Bridge Equipment Loaded for Transport.

The bridge company has 96 organic trailers. This number is sufficient to carry 50 percent of each bridge on trailers so that when trucks are furnished, the truck and trailer combination will transport all of the bridge equipment. A major disadvantage to this system is that in order to move a bridge company to an overseas staging area, ninety-six 5-ton capacity trucks are committed for the entire movement period. One platoon allowance of M4T6 bridge requires committing 24 trucks. When the bridge equipment is not employed immediately upon reaching the staging area, either the trucks remain unavailable for other tasks or half the bridge equipment has to be unloaded and reloaded when needed.

a. As an alternative, each bridge set may be divided into a specified number of loads. The average load weight is between 6 and 7 tons. In general, a load is one bay of a bridge, an integral unit of a related structure such as an approach ramp, or an allowance of equipment for a special task such as anchorage and abutment construction. Critical equipment is distributed throughout several loads so that if a carrier is disabled or a load destroyed, the capability of the bridge is reduced by 15 feet, but the construction is not seriously impaired. Loads are numbered according to the anticipated arrival sequence at an assembly site and designated as to the equipment contained. They are sufficiently flexible to fit special construction situations without requiring excessive equipment handling.

b. The loading system is designed primarily for transportation on trailers alone, one load per trailer. If prime movers are assigned solely for bridge transportation, the load can be divided between the truck and the trailer. For overland and across the beach movement, the weight of a load is close to the maximum allowed for the truck and the trailer combination and additional equipment is not carried on the vehicle. The load can be increased when travel is confined to suitable roads. Each component in a load has a designated position on the trailer. The arrangement of the components on the trailer is planned to provide for minimum overall dimensions and for unloading the equipment in the proper sequence for construction. Most of the loaded trailers are 28 feet long, 8 feet wide, and 11 feet in height. The maximum weight of a loaded trailer is 12 tons.

c. With this loading system, one complete platoon allowance can be loaded on 4 footbridge trailers, 24 M4T6 trailers, and 18 T6 trailers. Two complete platoons can be loaded on organic trailers. The main limitation of this plan is that if the trucks cannot be utilized for both load carrying and trailer towing, the equipment of the remaining bridge platoon must be bulk loaded for embarkation and port handling. In the event all three platoons are employed simultaneously, carriers for the equipment of the last platoon must be provided by the supported unit.

d. Based on the foregoing, it is possible for planners to make a rough estimate of truck requirements for the employment of the bridge equipment. As an example, if 330 feet of M4T6 bridge is to be assembled, one platoon set plus 60 feet or 4 bays is required. This is roughly 24 plus 4 or 28 loads. For cross-country movement, 28 trailers will be needed and 28 prime movers must be furnished. If the vehicles are to be moved over suitable roads, the trucks can carry part of the equipment and the prime mover requirement is reduced.

6503. EMBARKATION

Prepared for embarkation, the bridge company weighs more than 1,600 tons. Its organic vehicles cover about 27,000 square feet of deck space. The total cube of all cargo is in excess of 350,000 cubic feet, and over 175 heavy lifts are required in addition to vehicle lifts.

a. Loading.--Once the required bridge equipment to be shipped is determined, and the necessary bridge unit attached, the bridge company embarkation officer is included in the embarkation planning of the supported engineer unit. The movement of vehicles to a port of embarkation requires vehicular support. If bulk-loaded equipment is embarked, the prime movers can be utilized as carriers. When prachicable, rail movement is considered. Special slings are required for loading bridge trailers aboard ship. These are furnished by the company. Normally, the most feasible location for trailer storage is on the weather decks. Backing trailers into close positions is difficult and time consuming. Extensive training is required to familiarize drivers in the technique of maneuvering trailers. Arrangements are made to billet bridge company personnel aboard ships carrying loaded trailers for the purpose of maintaining the loads during passage. Ideally, prime movers are loaded with the trailers.

b. Unloading.--Unloading is most effectively executed at a port facility. If LST space can be utilized, trailers can be unloaded across the beach. Unloading "in the stream" into landing craft is the least desirable method because of the size, weight, and limited stability of the

loads. An important consideration during unloading, as with all activities, is the assignment of required prime movers to transport the trailers from the beach to the staging area or to immediate employment at a crossing site. Helicopter transport of bridge equipment, from ship-to-shore or to assembly sites, is feasible under certain conditions and is given consideration.

6504. BRIDGE UNIT PLANNING

a. General.--At the bridge unit level, a river-crossing operation consists of eight steps. Some of these steps may be executed simultaneously and some may be eliminated, depending on the type of crossing. These eight steps are:

(1) Planning.

(2) Nearshore seizure.

(3) Farshore seizure.

(4) Site preparation.

(5) Initial buildup.

(6) Main crossing.

(7) Maintenance of crossing.

(8) Improvement of crossing.

b. Initial Planning Stage.--Both hasty and deliberate crossings are characterized by detailed planning by the engineer units responsible for bridging. Tactical and technical plans are formulated by higher echelons. Based on the tactical situation, the most feasible site is chosen, and the engineer operation is scheduled. An engineer unit is assigned the mission of constructing the crossing facilities, and the supporting bridge unit, with its equipment and necessary security forces, is attached. The engineer and bridge unit leaders should, if at all possible, conduct a ground reconnaissance of the proposed site. Some of the necessary technical information required covers:

(1) River characteristics, natural obstacles, and flood potential.

(2) Approaches and bank conditions at the site.

(3) Location of assembly and equipment staging areas, and construction of troop bivouac areas.

(4) Availability of natural materials for anchorages and abutment construction.

(5) Site security requirements.

c. Detailed Planning.--Using the reconnaissance information, the engineer and bridge unit leaders plan the "nuts and bolts" of the crossing facility. Included in this plan are:

(1) Determination of exact standard bridge and bridge erection equipment requirements.

(2) Design of anchorages, abutments, and bridge protective devices.

(3) Formulation of an effective bridge equipment loading plan.

(4) Scheduling and procurement of required transportation and erection equipment.

(5) Organization of assembly crews and assignment of bridge personnel.

(6) Site layout, including assembly sites, unloading sites, equipment staging areas, erection traffic routes, and site communications.

(7) Scheduling of equipment arrival and unloading.

(8) Scheduling of assembly work sequence.

d. Alternate Plans.--In addition to the desired assembly plan, alternate plans are formulated for expedient and improvised construction in the event some of the required equipment does not reach the site or is destroyed during assembly. The bridge unit leader plans for the maintenance of the erected structure. Any personnel or equipment augmentation requirements for this task are submitted to the supported engineer unit and included in the river-crossing plans.

e. Nearshore Seizure.--Actual seizure of the nearshore is a tactical mission assigned to assault units of the attacking force. In a hasty crossing, the bridging unit is in close support of the assault force, prepared to rapidly erect crossing facilities as soon as the site is secured. The bridging detail is included in the attack order and close coordination between the tactical and the engineer units is required. For the bridging unit involved in either type of crossing, this second step includes all the preparations and activities required to move the assembly crew and equipment to the nearshore site. Bridge equipment is loaded at rear area staging points or preloaded on trailers, as necessary. If helicopters are to be used for transporting the equipment, special loads are planned. Bridge personnel perform all loading and are responsible for completeness of the load. Labor and loading equipment augmentation may be required, depending on the strength of the attached bridge unit. Training and rehearsals are conducted, particularly when untrained troops are employed. Coordination with supporting motor transport elements is essential to ensure that trailers depart from the staging area according to the planned arrival sequence. The designed time schedule for load arrival at the assembly site is executed precisely, to ensure effective assembly procedures. Erection traffic control at the site is conducted by bridge personnel. The success of the bridge assembly operation is dependent on teamwork and coordination between the tactical, bridging, and supporting units during this movement to and seizure of the nearshore site.

f. Farshore Seizure.--The tactical assault on the farshore employs all available river-crossing facilities to cross the assault elements of the landing force. Helicopters, amphibious tractors, assault boats, floating footbridges, expedient vehicle bridges, and light rafts may be employed

during this step. The footbridge is normally assembled as an aid to the construction of heavier bridges and, if the tactical situation permits, may be utilized for the tactical crossing.

g. Site Preparation.--Layout and preparation of the crossing and bridge assembly sites commence as soon as tactically possible. (See fig. 65.) This work may proceed simultaneously with the nearshore and farshore seizures. Farshore bridging crews cross closely behind the assault units. Site preparation is just sufficient to satisfy the crossing needs at each stage of the operation. As the crossing develops, more detailed preparation is needed.

h. Initial Buildup.--As the bridgehead is opened by the assault, heavier facilities are required to cross the reinforcing units and their equipment. Light and medium rafts are used to maintain the crossing while a bridge is being assembled or a heavy rafting operation is developed. Medium capacity M4T6 rafts can be rapidly assembled, utilized for the initial buildup, and then connected to the bridge. This technique provides for a continuous employment of the equipment without a major delay through several steps of the operation. Bridge personnel supervise assembly crews, operate the rafts, and control crossing traffic during this step.

i. Main Crossing.--The main crossing involves the construction and operation of facilities for the main body of the advancing force and is the

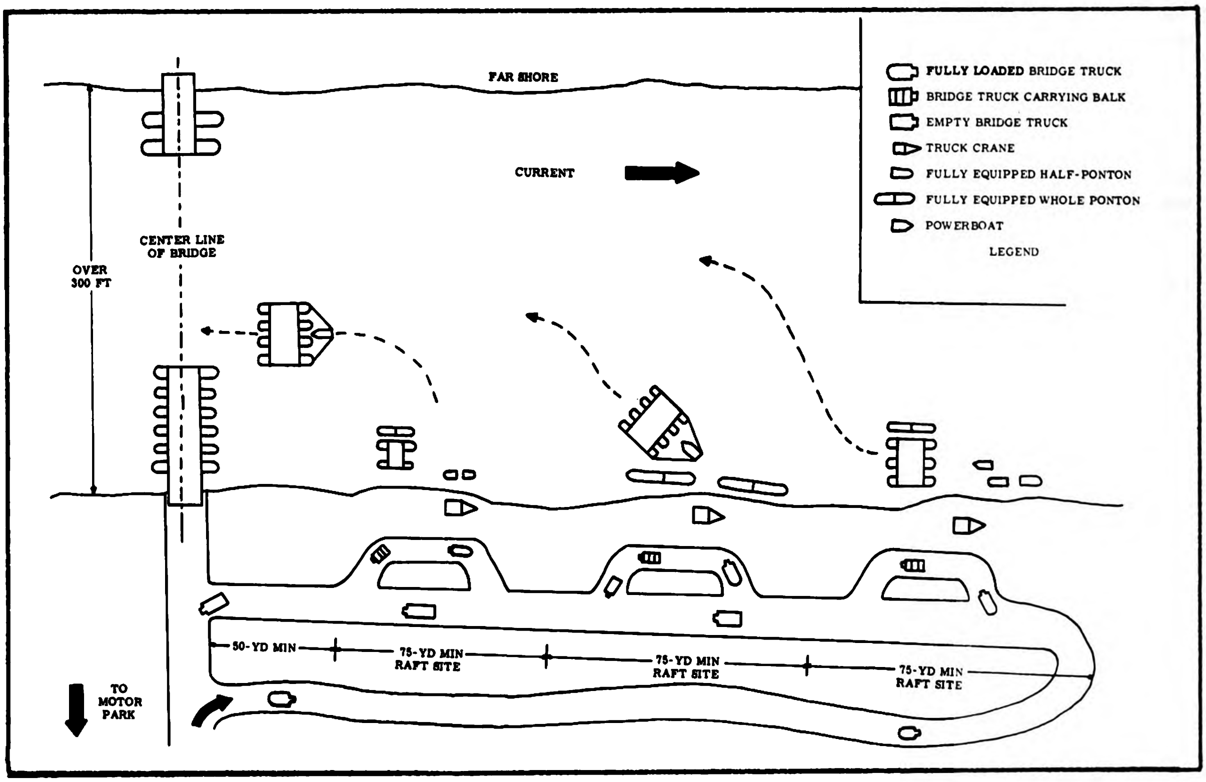


Figure 65.--General Site Layout.

primary objective of the bridging unit. It can be either a highway type bridge or a multiraft ferry. The facility is normally of high capacity and capable of crossing the heaviest load in the landing force. If the crossing is to be a link in a main route of communication, the facility may be employed for the duration of the tactical operation. Construction of the main crossing can be executed by the same unit that provided the initial crossings or by a special unit brought up for this mission. For divisional loads, the erection of the main crossing is a major engineering project. The applicable standard bridging equipment is the M4T6 bridge, the M6 bridge, and reinforced rafts for ferrying. In either a hasty or deliberate crossing, the main crossing is scheduled as a continuation of the initial steps, with a minimum delay in the transition.

j. Maintenance of the Crossing.--Bridge maintenance considerations are included in the overall engineer plan for the crossing. Augmentation troops and equipment are required, depending on the size of the structure and the site conditions. The maintenance detail can either be returned to bridge company control or remain attached to an engineer unit according to the employment situation.

k. Improvement of the Crossing.--Crossing improvement consists of reinforcing the standard structure for increased capability, or replacing the standard equipment with a nonstandard facility such as a timber trestle bridge. Also included in this step is disassembly of the standard structure and movement of the equipment to a staging area for future employment. These tasks are directed by the responsible engineer command. The construction of a nonstandard structure is an engineer mission and is not normally assigned to bridge company units.

6505. BRIDGE TRAINING

A high level of bridge training is maintained by Fleet Marine Force engineer units. To effectively utilize standard bridge equipment, engineer personnel should be adept in assembly procedures. Engineer officers require a detailed knowledge of planning and employment techniques. Combined bridge company-engineer unit training exercises and unit bridge schooling ensure the bridging proficiency of personnel concerned. Normally, the following bridge training is conducted prior to a river-crossing operation:

a. Reciprocal familiarization lectures.

b. Bridging instructor classes conducted by bridge personnel for selected engineer unit instructors.

c. Engineer troop bridge construction classes.

d. Field bridge schools conducted by the bridge company.

e. Engineer officer and NCO schools covering employment techniques, bridge reconnaissance, bridge erection, and anchorage design.

f. Combined unit field training exercises including tactical blackout, and swift current assembly operations.

g. Combined unit assembly exercises involving utilization of infantry and other untrained personnel for labor crews.

h. Embarkation studies and exercises.

Section VI. BRIDGES AND RAFTS

6601. GENERAL

Standard military bridge equipment available to a landing force consists of prefabricated components which can be rapidly assembled at a crossing site. This section presents a description of the standard bridge equipment organic to the force bridge company. The capabilities described for each type of structure that can be assembled from a specific set requires the use of all components. Combinations of various structures, such as a bridge and a raft, reduce the capabilities of each type. Assembly time and manpower estimates are based on excellent site conditions and trained personnel. Less favorable conditions will increase the assembly requirements. For a more detailed discussion of military bridging, see TM 5-210, Military Floating Bridge Equipment; TM 5-216, Armored Vehicle Launched Bridge; TM 5-260, Principles of Bridging; TM 5-270, Cableways and Tramways; TM 5-271, Light Stream Crossing Equipment; TM 5-277, Panel Bridge, Bailey, Type M2; TM 5-279, Suspension Bridges for Mountain Warfare; TM 5-312, Military Fixed Bridges; and DA-TB 5-268-1, Bridge, Fixed, Panel, Single Lane, Aluminum.

6602. TERMINOLOGY

To provide for clarity, the following terms used with standard bridging are defined:

a. Abutment.--The ground supports of a bridge at the nearshore and the farshore.

b. Anchorage.--An accessory structure of a floating bridge that holds the bridge alignment against the force of the current. An anchorage system can be an overhead cable, guylines from the shore to the bridge, anchors holding the bridge to the river bottom, or combinations of these three systems.

c. Bay.--The smallest integral part of a standard bridge. Assembled bays are connected to form the bridge.

d. Expedient.--Improvised construction.

e. Farshore.--The shore to which the bridge is built.

f. Fixed Bridge.--A bridge supported on the ground at various points by fixed or rigid supports.

g. Floating Bridge.--A bridge supported by a floating substructure. Used only to cross bodies of water.

h. f.p.s..--Feet per second; the unit of velocity of stream current.

i. Nearshore.--The shore from which the bridge is built.

j. Span.--The length of the structure measured between the nearshore abutment and the farshore abutment.

k. Substructure.--The lower part of a bridge that supports the superstructure.

l. Superstructure.--The upper part of a bridge reaching from shore to shore and carrying the crossing traffic; the deck of a raft.

6603. BRIDGE AND VEHICLE CLASSIFICATION SYSTEM

All standard vehicles, wheeled and tracked, are given a vehicle class number. This number represents the effect a vehicle will have on a bridge in crossing it. This class number is determined from the gross weight of the vehicles and the distribution of this weight. Vehicle classification data is contained in FM 5-36, Route Reconnaissance and Classification. All military bridges have their rated capacities indicated by an appropriate bridge classification number. This number represents the safe, load-carrying capacity of a bridge under normal crossing conditions. A normal condition is one of three crossing conditions.

a. Normal Crossing.--A crossing condition in which the vehicle classification number is equal to or less than the bridge classification number. Vehicles must, however, maintain 30-yard intervals, restrict their speed to within 25 m.p.h., and not stop or accelerate suddenly.

b. Caution Crossing.--A crossing for which the vehicle class number is not more than 25 percent greater than the bridge class number. Caution crossings require that vehicles remain on the centerline of the bridge, maintain 50-yard intervals, do not exceed a speed of 8 m.p.h., and do not stop, accelerate, or shift gears on the bridge.

c. Risk Crossing.--A crossing permitted only on standard prefabricated fixed and floating bridges in the gravest emergencies when excessive losses would otherwise result. The vehicle crossing must remain on the centerline, not exceed 3 m.p.h., be the only vehicle on the span, and not stop, accelerate, or shift gears on the bridge. Risk crossings can be made only if the vehicle class number does not exceed the published risk class.

6604. ALUMINUM FLOATING FOOTBRIDGE

The floating footbridge is the close support bridge of the force bridge company. It is used to cross troops on foot, or with expedient construction, light vehicles. (See figs. 66 and 67.) It can be assembled rapidly, quietly, and under blackout conditions. The components are helicopter transportable and the bridge is not easily destroyed by small arms fire.

a. Structural Variations.--The following structures can be assembled from one platoon allowance (two bridge sets):

(1) 610-foot assault footbridge, or

(2) 205-foot expedient vehicle bridge, or

(3) 10 light personnel rafts, or

(4) 3 light vehicle rafts.

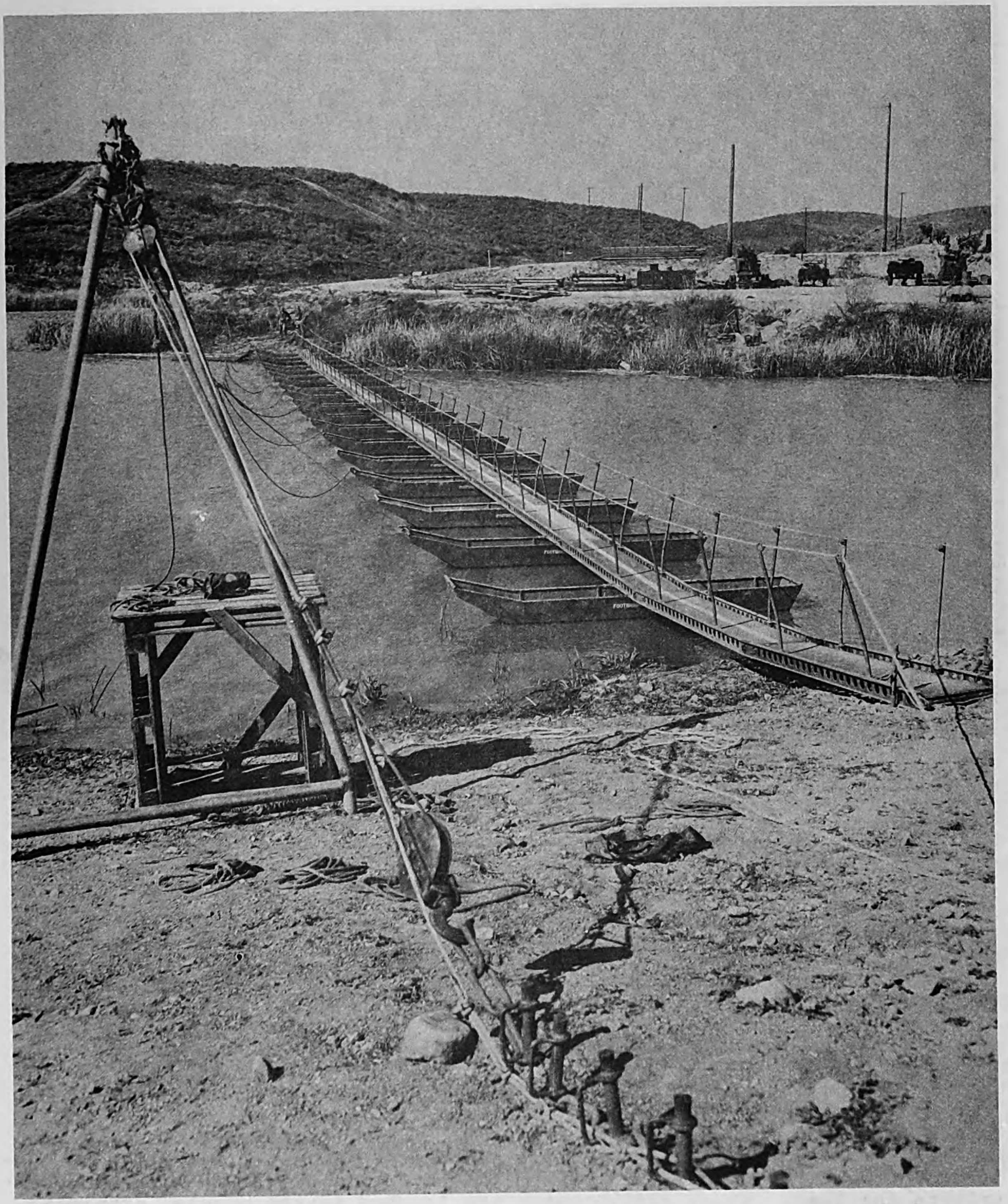


Figure 67.--Floating Footbridge Installed.

vehicle bridge will support a 1/4-ton truck in currents not over 5 feet per second. Vehicles must travel slowly in low gear with extreme caution.

d. Site Conditions.--The site should have sufficient clearing at the nearshore for unloading and assembly. Approach and exit paths are cleared of trees and brush. Gently sloping banks are recommended for ease of construction, but steep bank assembly is possible. A site at which the stream current is even and parallel to the bank is best. The current cannot exceed 11 feet per second for assembly of the footbridge and 5 feet per second for the vehicle bridge. Construction of adequate anchorages is required.

e. Assembly Requirements.--The most effective size crew for the assembly of the bridge is one NCO and 10 men. Additional men are required to construct the anchorage. The size of the anchorage crew depends on the type and length of the anchorage. In daylight, the estimated assembly time is 30 minutes plus 1 minute per bay. Blackout assembly takes about twice as long. No special equipment is required for bridge assembly. Construction and rigging tools are required for the anchorage.

6605. M4T6 FIXED AND FLOATING BRIDGES

Fixed and floating structures, including rafts capable of crossing class 60 loads, can be assembled from the M4T6. (See figs. 68, 69, 70, and 71.) They can be constructed rapidly and under blackout conditions. The components are helicopter transportable. The floating supports can be damaged by small arms fire.

a. Structural Variations.--The following structures can be assembled from one platoon allowance:

(1) 270-foot floating highway bridge, or

(2) Five class 30 rafts, or

(3) Four class 50 rafts, or

(4) Two class 60 rafts, or

(5) Eight fixed spans.

b. Span Lengths.--The given span lengths are for normal construction. Expedient assemblies provide some increase in span capability of the set. Two separate bridges can be assembled from the 270 feet of floating bridge. The maximum length of a fixed span is 45 feet. The combined length of all fixed spans cannot exceed 330 feet. The number of rafts that can be operated is limited by available propulsion equipment.

c. Components and Assembly.--The M4T6 floating bridge is a single lane aluminum roadway supported by inflated rubber pontoons. Steel saddles hold the roadway to the floating supports. The substructure of one bay is assembled by connecting two pneumatic pontoons to form a float. Steel reinforced plywood panels are strapped to the upper surface of the float to distribute the load. Steel saddle beams are latched to the panels, providing a rigid support for the steel saddle assembly that holds the superstructure to the float. The superstructure is assembled of aluminum "timbers," called deck balk, that are laid side by side and pinned to the saddle. Floats,

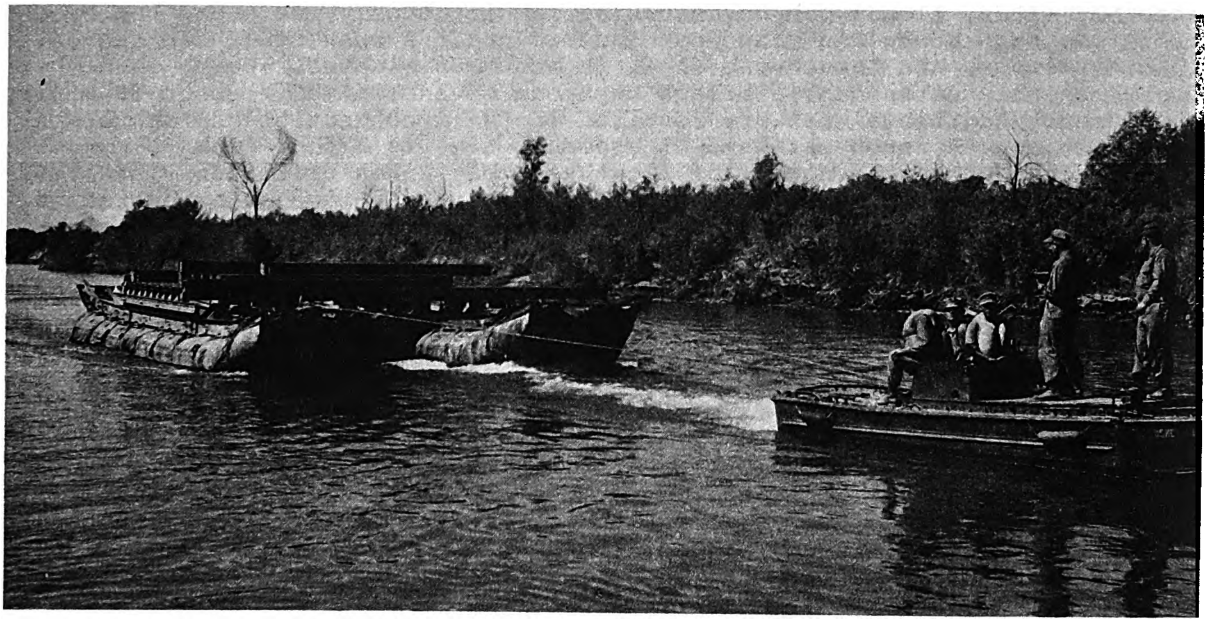


Figure 71.--M4T6 Raft.

complete with saddles, are assembled on the shore at float assembly sites and launched into the stream. Deck balk is used to connect the bays together. The bridge is assembled by connecting the individual bays or multibay rafts together, at the proposed bridge centerline. Fixed spans are erected by pinning deck balk to transverse beams called stiffeners. Steel transom trestles are used as intermediate supports, where required. Raft assembly for ferry operations is similar to the assembly for floating bridge bays.

d. Capacity.--The capacity of the floating bridge and the rafts depends on the stream current. Anchorages can be constructed for a given current to provide a class 60 crossing, but an increase in current will cause a decrease in bridge capacity. As an example, a class 60 floating bridge with an anchorage system designed for 3 feet per second will have the capacity reduced to class 45, if flood conditions cause a current increase to 9 feet per second.

e. Site Conditions.--Assembly sites should be clear and have gently sloping banks for launching floats. Approach roads and abutments are constructed at both shores. The stream current should be even and parallel to the banks. The current cannot exceed 11 feet per second for the construction of a floating bridge or rafting operations, For class 60 capacity, the maximum current is 8 feet per second. The stream should be free of obstacles at assembly sites and along the proposed centerline. Approach roads and raft crossing channels should be clearly marked.

f. Assembly Requirements.--The number of suitable assembly sites determines the assembly requirements of the floating bridge or rafts. The required anchorage system also influences assembly estimates. Using several

assembly sites, floats can be assembled simultaneously, reducing the erection time but increasing manpower requirements. A crew of 12 men can unload, assemble, and launch one float in about 30 minutes. Using three float assembly sites, three bridge bays can be assembled in about 30 minutes by 36 men. Additional men are required for balk connection and anchorage construction. A rough estimate of assembly time is 1 hour plus 30 minutes per bay divided by the number of float assembly sites utilized. This does not include construction of the anchorage, which can be a major operation. Compressors are required for float inflation. At least one compressor per float assembly site should be scheduled. A bulldozer is required for site clearing and construction of approaches and abutments. A crane is useful for lifting and launching. Approach roads may have to be constructed or improved.

6606. FIXED SPANS

Fixed spans are used to provide a crossing for vehicles and equipment over short gaps, such as washouts, ravines, demolished fixed bridge spans, blown culverts, ditches, and marshy ground, and in general, for any obstruction to the normal flow of traffic. Components of standard floating bridge sets lend themselves readily to quick repair and rapid installation, thereby reducing traffic congestion along the main supply route.

a. Types.--Fixed bridges assembled from components of floating bridge sets are either simple fixed spans or multifixed spans.

(1) Simple Fixed Spans.--Simple spans are unsupported spans extending from abutment to abutment across the gap in which they are employed. Simple spans can be assembled from 15 to 45 feet long depending on the equipage employed. The class of the bridge depends on the length of the span.

(2) Multifixed Spans.--Multispan bridges may be assembled from floating bridge components employing trestles as intermediate supports. The trestles are normally employed in pairs or multiples and braced to each other and to the ground. Trestles are normally spaced on 15-foot centers. The class of the bridge depends on the class of the longest single span and the class of the intermediate supports.

b. M4T6 Fixed Spans.--The deck balk fixed bridges assembled from the components of the M4T6 floating bridge are 167 inches in roadway width. The decks consist of hollow aluminum deck balk which acts as stringers and treads. Trestles are used for intermediate supports. The amount of bridging available is limited by the number of stiffeners and balk in the bridge set. A total of 330 feet of fixed spans may be erected from the components of one bridge set. The number of spans depends on the length of each span, with the maximum being eight spans.

c. M6 Fixed Panel Bridge.--The M6 bridge is similar to the World War II Bailey bridge, but requires less time and personnel to erect. It has limited span capability and application flexibility. Steep walled ravines and narrow streams with currents swifter than 11 feet per second are sites suitable for the employment of the M6 bridge. It cannot be used to reinforce existing nonstandard bridges. The components cannot be effectively transported by helicopter.

(1) Capability.--One platoon set of M6 bridge contains sufficient components for the erection of three separate fixed bridges, the total

length not to exceed 210 feet. With an expedient assembly, two 120-foot spans can be constructed. For class 60 capacity, the maximum length of a span is 135 feet. The total capability of the company is triple the above. In addition, the company can provide greater span lengths for class 60 loads by combining components from the platoon sets. Using two sets, one span 195 feet long can be erected. With all three sets, the maximum span is 240 feet.

(2) Components and Assembly.--The M6 fixed bridge is a single lane, aluminum, pony truss bridge. Two parallel rows of vertical panels, one row on each side of the roadway, provide the strength for the span. The capacity of the bridge can be increased by erection of double or triple rows of panels on each side. Aluminum and steel ramps form the approaches at each end of the bridge. A bay of M6 bridge consists of two truss panels erected vertically and supporting transverse floor beams. Four aluminum deck panels are laid between the truss panels, resting on the floor beams. Bracing is connected horizontally between the truss panels and vertically from the truss panels to the floor beams. Curbs and a walkway for foot troops are added to the bay. The effective length of the bay is 15 feet. The bridge is assembled by connecting the bays together on the nearshore and pushing it out to the farshore. Initially, an accessory structure, the launching nose is assembled on rollers. The first bridge bay is connected to the launching nose and the structure is pushed out, bay by bay, as they are erected at the nearshore end. When the first bay reaches the farshore rollers, the launching nose is disassembled and staged out of the way. Hydraulic jacks are used to remove the rollers and set the bridge down on the abutments. Approach ramps are then added to each end of the bridge.

(3) Capacity.--The M6 bridge is a class 60 bridge.

(4) Site Conditions.--The site must have strong abutments capable of supporting the load of the bridge and traffic. Abutment construction can be a major engineering project at some sites. The nearshore site must be clear and level far enough behind the abutment to permit effective bay connection.

(5) Assembly.--The M6 span can be assembled either with the aid of a crane or by manpower alone. Crane erection is more efficient. With a crane, 24 men are required plus equipment operators. A general time estimate for this crew is 1 hour plus 20 minutes per bay. The time does not include abutment construction, which must be completed prior to bridge erection. Erection by manpower requires approximately three times as many men as when a crane is available. The assembly time is about the same. These estimates are for single truss (two panels per bay) erection. Multi-truss assembly increases the requirements. A crane and tractor should be scheduled for the project. The tractor can be utilized to construct the abutment and push the bridge before launching. All special erection tools are included in the bridge set.

6607. M4T6 RAFTS

a. General.--The M4T6 five-float, reinforced raft is one of the most flexible and effective river-crossing facilities available to the landing force. The main tactical advantages of the raft are:

(1) Capability.--Rafts are capable of ferrying division loads in currents up to 11 feet per second.

(2) Span.--Rafts are not limited to the relatively short span of the complete bridge sets.

(3) Transportation and Assembly.--Rafts are more easily transported and assembled than floating bridges.

(4) Protection.--Rafts are not stationary targets like bridges. Rafts can be concealed during daylight and operated at night to prevent observation.

b. Raft Types.--Several types of rafts can be constructed from the M4T6 bridge set:

(1) Four four-float normal rafts.

(2) Two four-float reinforced rafts.

(3) Three five-float normal rafts.

(4) Two five-float reinforced rafts.

(5) Two six-float reinforced rafts.

c. Overhang.--The five-float reinforced raft can be assembled with either the 21-foot 8-inch overhang, or the 16-foot 7-inch overhang. The site conditions at the loading and the unloading points determine which overhang is used.

d. Capacity.--The raft capacity is determined by the current velocity and the propulsion equipment.

6608. RAFTING OPERATIONS AND WATERMANSHIP

Rafting is the most flexible and the most difficult method of river crossing. The demands for detailed training and coordinated teamwork are far greater than for other phases of bridging.

a. Propulsion Equipment.--Several methods of propelling rafts are available. The main equipment includes the 27-foot-bridge boats, outboard motors, trail ferries, and flying ferries. The bridge boat is powered by twin engines, each driving a single propeller. The boat has a two-section hull which consists of the bow section and the stern section. The stern section contains the engines and the operating controls. Unloaded, the boat has a draft of approximately 40 inches. The crew of the bridge boat consists of the operator and an assistant. The operator is in charge of the craft and is responsible for its maintenance and operation. The boat operator is one of the critical men in the rafting operation, and he is well trained in the techniques of boat handling.

b. Raft Sites

(1) Site Selection.--The following are desirable site characteristics:

(a) Current of 0-5 feet per second.

(b) Uniform current across channel.

(c) Banks requiring minimum preparation.

(d) Approaches extending to road nets.

(e) Strong natural holdfasts.

(f) No shoals, sandbars, or snags.

(g) Absence of obstacles immediately downstream.

(h) Absence of mines and boobytraps.

(2) Loading and Unloading Points

(a) Loading and unloading points should, if possible, be located directly across from each other.

(b) If the current is so swift that the raft cannot be pushed straight across, the unloading point is located drift distance downstream from the loading point.

(c) Abutments are constructed at loading and unloading points to carry the overhang ramps without grounding the float and to prevent caving of the bank. With heavy traffic, the abutments require frequent inspection and maintenance.

(d) Loading and unloading points are clearly marked in night or foul weather operations so they can be readily identified during crossing.

(e) Where approaches are easily constructed, multiple loading points can be utilized. Multiple loading points prevent bottlenecks due to vehicle breakdown and add to dispersion of crossing units. Multiple landing points are located at least 100 feet apart.

(3) Shore Anchorages.--Strong anchorages are required to secure rafts during loading and unloading. Construction of shore anchorages is part of site preparation. Mooring lines should be at least one inch rope.

(4) Channels.--In shallow or snag-bottom water, channels are carefully plotted and marked. When possible, boat operators make "dry runs" of channels to become familiar with them. If necessary, working parties clear channels during site preparation.

(5) Raft and Boat Mooring Sites.--Where tactical conditions require concealment of the river-crossing facilities during daylight, preplanned raft and boat mooring sites are constructed. These sites should provide maximum concealment for the craft and adequate mooring anchorages.

c. Raft Crews.--Teamwork and training determine the effectiveness of the raft crew. Each man in the crew is thoroughly trained and constantly alert.

(1) Crew Size.--The normal crew for one raft is one NCOIC and 12 bridgemen. Additional men may be required depending on site conditions. In sustained operations, a complete alternate crew is used to prevent loss of efficiency.

(2) Duties of the Crew

(a) NCOIC.--Commands the raft, supervises the crew, and directs the boat operators. Throughout the operation, the NCOIC is responsible for maintenance of the raft.

(b) Boat Crew.--The boat crew (operator and assistant) operate the boat and handle raft connecting lines.

(c) Nearshore Line Detail (Four Men).--The nearshore line detail is stationed on the nearshore end of the raft; handle nearshore lines and vehicle wheel chocks.

(d) Farshore Line Detail (Four Men).--The farshore line detail is stationed on the farshore end of the raft. They handle farshore lines and vehicle wheel chocks.

(e) Guides.--One guide is positioned on each shore. The nearshore guide instructs drivers on loading procedures and guides vehicle onto raft.

(f) Additional Duties.--In addition to the above duties, crewmen on the raft standby anchors during crossings, ready to cast them on the order of the NCOIC.

d. Raft Operation

(1) Loading Instructions.--The following instructions are given to drivers by the nearshore guide:

(a) Use all-wheel drive.

(b) Drive on raft steadily and slowly.

(c) Stop with front wheels against chocks.

(d) Follow directions of NCOIC on raft.

(e) Set brakes and leave motor running.

(f) Stay in driver's seat.

(g) When unloading, start forward gently on signal of farshore guide. Move slowly and steadily until completely off raft.

(h) All other vehicle personnel will loosen packs and dismount prior to loading on raft.

(2) Loading

(a) The nearshore guide directs vehicle on raft to position on downstream side of deck.

(b) As vehicle presses ramp down, the raft is steadied with the boat.

(c) The nearshore crew removes lines from holdfasts and boards raft.

(d) When necessary, the vehicle is driven beyond balance point to raise ramp clear of abutment. The vehicle is recentered when the ramp is clear.

(e) The vehicle is chocked, fore and aft.

(f) When nearshore crew is aboard, the stern of the raft is swung toward shore and the throttle opened. The raft is faced at an angle to the current.

(3) Crossing.--Detailed techniques for crossing depend on the current, load, channel, and visibility. It is important to use sufficient power and to maintain coordination between the NCOIC, crew, and boat. Other features to be considered during crossing:

(a) Power.--Always keep enough power to maintain headway in the stream. Do not allow the raft to drift downstream unless a downstream unloading point has been prepared for drift.

(b) Crossing Angle.--In stream currents, the raft crosses at an angle to the current in order to compensate for drift. Only in still water can the raft be pointed directly cross stream. The size of the crossing angle depends on the velocity of the current.

1 In currents less than 5 feet per second, cross at 30 degrees to the current. This means that a line from the boat (pushing) through the bow of the raft will make an angle of 30 degrees with the direction of the current flow.

2 In currents 5 feet per second and over, reduce the crossing angle by turning the raft further upstream.

3 If the crossing angle is greater than 30 degrees, the force of the current may whip the raft around toward downstream and control will be lost.

(c) Crossing Above Obstacles or Structures.--When operating above bridges, dams, log booms, and other obstacles, keep sufficiently far upstream to allow for maneuvering and emergency action. In currents over 5 feet per second, heavy rafts should cross at least 1,800 feet above any obstacle.

(d) Channel Crossings.--Channel crossing and crossing in shallow water or foul water require a high degree of alertness and careful coordination between the NCOIC and the boat operators. These crossings should be well marked and clear of obstacles. Boat crews work closely together and, if possible, are given the opportunity for practice crossings with an unloaded raft. It may be necessary to take soundings during the crossings to prevent grounding.

(4) Landing and Unloading

(a) Approach the landing from downstream and at an angle.

(b) Aim for contact of off-loading ramps with abutment.

(c) As raft touches, farshore line crew rapidly ties lines to holdfasts.

(d) Do not shut off motor until all lines are secure.

(e) Farshore guide directs vehicle off raft and toward approach road.

(f) If necessary, back vehicle offshore of raft balance point to raise overhang enough to clear abutment for landing.

(5) Communications.--A coordinated communication system is established between the NCOIC and boat operators, landing points and raft, and loading and unloading points. Radio and phone systems are useful when available. Hand and light signals are prearranged between NCOIC and boat operators.

(6) Rafting Precautions.--The following precautions are observed during rafting operations:

(a) All men working over water wear life preservers.

(b) Always use plenty of power.

(c) Do not operate immediately upstream of obstacles.

(d) Use rope in good condition.

(e) Coil all lines not in use on the deck.

(f) Have anchors rigged and ready for casting in an emergency.

(g) If possible, station a pickup boat downstream from the crossing site and tie it into the communication system.

(h) Do not blouse trousers.

(i) Never overload raft.

(j) Reduce loads in swift and rough water.

(k) Maintain raft and landing points throughout operation.

(l) Never cast off with dead motor.

(m) Keep raft headed into current.

(n) In swift streams, the first load is about half-capacity in order to check equipment.

(o) Hold rafts tightly against shore during loading and unloading.

(p) Make allowances for reduced freeboard due to wave action.

(q) Center vehicle along axis of raft but on downstream side of deck (to keep bow high).

e. Maintenance.--Maintenance of the raft and crossing site is one of the most important features in rafting operations. Maintenance work is divided into three classes: raft maintenance, boat maintenance, and landing point maintenance.

(1) Raft Maintenance.--Raft maintenance is the responsibility of the NCOIC of the raft. It includes:

(a) Inspection of the raft after each crossing to ensure all equipment is in operating condition.

(b) Inflation of the raft. Provisions are made for the reinflation of pontoons during operations. Compressors can be stationed at the landing points or on the raft. Inflation cannot interrupt the crossing time schedule.

(c) Checking all lines, straps, pins, and connections.

(2) Boat Maintenance.--Boat maintenance is the responsibility of the boat operator. It includes:

(a) Regular operational maintenance of boat throughout operation. Operator notifies NCOIC well in advance for refueling.

(b) Inspection and repair of all rigging lines connecting the raft to the boat.

(3) Landing Point Maintenance.--Nearshore and farshore maintenance crews are organized and equipped prior to the operation. Each crew is responsible for the maintenance of the offshore approaches, abutments, shore anchorages, and approach roads of their landing points.

APPENDIX A

A TYPICAL RAID ORGANIZATION

<u>RAIDING GROUP (TG 50.2)</u>		LtCol DOE
<u>Raiding Group Headquarters (TU 50.2.0)</u>		
CO, 1st Bn, 4th Mar	1	
S-3	1	
Det, Comm Plat, H&S Co, 1/4	4	
	6	
<u>Reconnaissance Element</u>		Lt BROWN
Recon Officer	1	
Amphib Recon Teams (AN/PRC-77)	8	
	9	
<u>Raiding Unit (TU 50.2.1)</u>		Capt WHITE
<u>Raiding Unit Cmd Gru</u>		
CO, Co C, 1st Bn, 4th Mar	1	
Co GySgt	1	
Msgr/Rad Opr (AN/PRC-77)	1	
Interpreter	1	
	4	
<u>Raiding Element ALFA</u>		Lt GREEN
Hq: Plat Comdr	1	
Interpreter	1	
81mm FO Team (AN/PRC-77)	2	
Corpsman	1	
	5	
Team 1: Fire Team	4	
Team 2: Fire Team	4	
Team 3: Plat Sgt	1	
Rifle Squad	13	
MG Team	2	
Rocket Team	2	
	18	
Team 4: Plat Guide	1	
Rifle Squad	13	
MG Team	2	
AA Gun Crew	3	
	19	
Team 5: 81mm Mort Sqd (-) (AN/PRC-25)	5	

Raiding Element BRAVO			Lt GREY
Hq:	Plat Comdr	1	
	Corpsman	1	
	81mm FO Team (AN/PRC-77)	2	
		4	
Team 1:	Plat Sgt	1	
	Rifle Squad (-)	9	
	Rocket Team	2	
		12	
Team 2:	Plat Guide	1	
	Rifle Squad (-)	9	
	MG Team	2	
	Rocket Team	2	
		14	
Team 3:	Fire Team	4	
	MG Team	3	
		7	
Team 4:	Fire Team	4	
	MG Team	3	
		7	

Raiding Element CHARLIE			Lt BLACK
Hq:	Plat Comdr	1	
	Plat Sgt	1	
	Msgr/Rad Opr (AN/PRC-77)	2	
	Corpsman	1	
		5	
Team 1:	Rifle Squad	13	
Team 2:	Rifle Squad	13	
Team 3:	MG Team	3	

Raiding Element DELTA			Lt REDD
Hq:	Plat Comdr	1	
	Plat Sgt	1	
	Msgr/Rad Opr (AN/PRC-77)	2	
	Corpsman	1	
		5	
Team 1:	Rifle Squad	13	
Team 2:	Rifle Squad	13	
Team 3:	Rifle Squad	13	

Raiding Element ECHO Lt BLUE

Hq:	ExO, Co C, 1st Bn, 4th Mar	1
	Rad Opr (AN/PRC-25)	1
	Msgr/Rad Opr (AN/PRC-77)	1
	Interpreter	1
		4

NOTE: One or more SFCP's will be included when naval gunfire support is available.

APPENDIX B

BIVOUAC CHECKLIST

____ Post a security guard.

____ Check the bivouac site.

____ Determine exact tent locations providing the best natural shelter and camouflage.

____ Designate an area from which construction materials and firewood may be obtained.

____ Select a water point or mark off snow areas that may be used for water.

____ Designate head and garbage disposal sites.

____ Designate a site for weapon and ski racks.

____ Break a minimum number of trails between the tent site and area assigned for firewood and construction material, water point, and head.

____ Maintain camouflage and track discipline at all times.

____ Organize and assign work details as follows:

  ____ Clear and level shelter sites.

  ____ Pitch tents.

  ____ Cut, trim, and haul trees for construction.

  ____ Construct improvised shelters.

  ____ Construct windbreaks.

  ____ Build necessary weapon racks.

  ____ Construct field heads.

  ____ Prepare a water point.

  ____ Gather and cut firewood.

  ____ Start fires and prepare hot chow.

____ Maintain and emphasize cleanliness, tidiness, and team work.

____ Arrange equipment inside and outside of shelters upon their completion.

____ Maintain a duty roster for exterior guards, fire guards, and similar assignments.

____ Prepare defensive positions and break and mark trails from shelters to these positions.

____ Rotate all individuals on all jobs on a daily basis.

____ Assign specific sleeping areas for all individuals in accordance with the duty roster.

____ Remove the exterior guard when the parent unit has taken over the security of the area.

____ Inspect the area, examining the security, camouflage, cover, weapons, and the conditions of the men and their equipment.

____ Outline and rehearse the action to be taken in case of attack.

APPENDIX C

MAINTENANCE CHECKLIST FOR COLD WEATHER OPERATIONS

I. COOLING SYSTEM

____ Keep an antifreeze solution in the cooling system consistent with the lowest anticipated temperatures.

____ Never mix water or other types of antifreeze with arctic antifreeze.

____ Keep system full at all times.

____ Keep all coolant connections leak-free.

____ Keep temperature gauge operative.

____ Use hood and radiator covers as required.

____ Make sure fan belt is correctly adjusted and in good condition.

____ Preheat cooling system before starting.

II. ELECTRICAL SYSTEM

____ Keep batteries fully charged.

____ Never allow any cell to go below 1240 specific gravity.

____ Keep all electrical connections tight.

____ Keep batteries free from corrosion, moisture, ice, and dirt.

____ Use correct starting procedures.

____ Keep insulation on battery box in good condition.

____ Keep battery heating pads free from leaks.

____ Paint battery with acid resisting paint.

____ Never try to charge a battery unless the electrolyte solution is at least 35 degrees Fahrenheit.

____ Never add water to a cold battery as the water will remain on top of the battery and freeze.

____ Never try to charge a battery by running the engine for prolonged periods of time.

____ When water is added, start the vehicle and move it to allow the water to mix with the electrolyte.

____ Never add acid to a battery; this causes the lead plates to break up.

____ Check for and report bare wires.

____ Preheat batteries before starting engine.

III. LUBRICATION SYSTEM

____ Use correct lubricants in crankcase and in all gear boxes.

____ Keep all lubricants free from dirt and water.

____ Check and replenish crankcase oil each time it is needed.

____ Idle engine a little above normal to keep oil pressure up.

____ Check for leaks.

____ Clean out shroud pan around crankcase after draining oil from the crankcase in order to prevent fires.

____ Never idle the engine for long periods.

____ Preheat engine before starting.

IV. FUEL SYSTEM

____ Add 1 quart of denatured alcohol to a 30-50 gallon fuel tank at the time of fueling.

____ Drain fuel sumps regularly to remove the alcohol water precipitate from the bottom of tank, then replenish with the correct amount of alcohol.

____ Check for, report, and repair all gasoline leaks.

____ Ensure the heat control valve is adjusted for cold weather operations.

____ Use primer pump correctly.

____ Never idle engine for long periods; this increases gasoline consumption and is a hazard to the engine.

____ Refuel vehicle after each operation when possible.

____ Keep snow and ice away from fillercap while removing it and refueling vehicle.

____ Use engine heater to preheat engine; this aids in vaporizing gasoline.

____ Prevent carburetor icing by warming up engine properly.

____ Halt and run up the engine for about 5 minutes to remove carburetor icing, then stop and allow to stand for about 10 minutes.

V. POWER TRAIN, STEERING, BRAKES, AND SUSPENSION SYSTEM

____ Keep U joints, bolts, and nuts tight.

____ Keep all mounting bolts tight.

____ Keep steering system tight and well lubricated.

____ Ensure brakes are properly adjusted.

____ Keep vehicle well lubricated.

____ Practice proper driving habits; drive sanely over rough roads, ice, and snow.

APPENDIX D

CHECKLIST FOR COLD WEATHER DRIVING

I. VISIBILITY

____ Remove all ice from all windows to give all-around vision.

____ Use defrosters to keep windshield free from ice.

____ Clean and adjust rear view mirror.

____ Use lights during snowstorms and just prior to dusk and dawn.

____ Allow for additional distance between vehicles when exhaust is causing ice fog.

____ Use guide when backing up or where a guide can assist in picking a trail in deep snow.

II. TRACTION FOR DRIVING AND STOPPING

____ Use chains in deep snow and on ice.

____ Place brush or burlap under wheels to aid in movement through deep ice and snow.

____ Never jam on brakes.

____ Brake a vehicle by releasing accelerator slowly and applying brakes with a feathering action.

____ Keep pioneer tools on all vehicles ready for use in removing excess snow and for cutting brush.

III. SPECIAL SAFETY PRECAUTIONS

____ Never sleep in a cab of a vehicle with the engine or heater running; exhaust gases may cause death by asphyxiation.

____ Always adjust speed to road conditions.

____ Keep proper distance and compensate for road conditions (3 to 11 times greater stopping distance may be needed on snow and ice).

____ Slow down before going around a curve.

____ Make slow, steady turns and stops.

____ Keep windows open slightly when heaters are being used.

____ Never stop in the center of a road.

____ Never pull off to the side of a road unless the shoulder has been checked; large ditches covered with snow give the appearance of a firm shoulder.

____ When hauling troops in the rear of a truck, be certain to instruct them to wait for the driver to assist in offloading.

____ Never overcrowd the cab of a vehicle with extra personnel or extra equipment; this cramps the driver, cuts down on his vision, and prevents him from maneuvering freely.

____ During halts, always check the vehicle for any troubles which may have occurred during operation.

____ Remove frost from headlights and stoplights.

____ Above all, use good judgment, be alert for other driver errors, and obey all traffic rules and regulations.

APPENDIX E

CHECKLIST FOR MOUNTAIN OPERATIONS

____ Individuals and units require physical and psychological conditioning and specialized training to operate effectively in mountain warfare.

____ In mountain operations, key terrain features include heights that dominate lines of communication, mountain passes, roads, and railroads.

____ The effects of low temperatures and sudden changes in weather conditions are considered when preparing plans for tactical operations in the mountains.

____ Mountainous terrain retards and restricts mobility and communications.

____ Due to the limited road net available and the nature of the terrain, pack animals and carrying parties are employed to augment and extend the capability of delivering supplies.

____ Helicopters increase combat effectiveness by providing a rapid means of displacing personnel and equipment, resupplying units, evacuating casualties, and by extending the surveillance capability.

____ T/E communication equipment may have to be supplemented with lanterns and flags for visual signalling and sometimes with radio equipment for relay and retransmission stations.

____ In mountain operations, unusual and unexpected opportunities for aggressive action that may influence the whole operation will often present themselves to the small unit leader.

____ In mountain operations, the use of combined arms and mechanized/motorized forces is limited by the terrain. Infantry elements of the landing force will play the dominant role.

____ In order to foster initiative, orders are general. Knowledge of the overall situation and the intent of senior commanders is conveyed to all junior leaders.

____ In offensive operations in the mountains, dominant heights, passes, and lines of communication are selected as objectives.

____ In mountain operations, envelopments are executed whenever possible. However, a flanking action is often impossible due to restrictions imposed by the terrain, and attacking units may be required to conduct frontal attacks.

____ In order to advance successfully, troops should move along ridges and high terrain features and avoid valleys and draws which are usually mined and easily defended.

____ In positioning reserves, the commander considers the probable area of employment, the difficulties involved in achieving mutual support, and the extreme time it will take to commit the reserves in mountain operations.

____ An unsupported night attack by stealth provides an excellent chance to achieve surprise and to conduct a successful assault without being exposed to observed and concentrated fires.

____ Lateral contact between adjacent units is seldom continuous and connecting patrols are dispatched frequently.

____ The attacker should not halt his assault on the topographic crest of a ridgeline objective, but should continue forward to or near the military crest before digging in and reorganizing.

____ In mountain operations, employment of artillery is characterized by greater preponderance of observed fires, greater decentralization of control, and increased difficulties in displacing and resupplying firing units.

____ The caliber and number of supporting weapons employed by attacking units is limited by their bulk and weight and the difficulty in resupplying them with ammunition.

____ In mountainous terrain, small units occupying dominant terrain may successfully defend against much larger units; therefore, consideration may be given to engaging small units with nuclear weapons.

____ The use of overhead, long range, and high angle fires is increased due to great differences in elevation, good observation, and the existence of a great amount of dead space.

____ Emphasis is placed on improvement of existing routes of communication since mountain roads and trails require extensive construction, improvement, maintenance, and repair to withstand increased traffic and severe weather conditions.

____ Engineer reconnaissance precedes all operations to obtain information on existing and future routes, soil trafficability, local construction materials, water points, natural and manmade obstacles, and estimates of engineer effort required.

____ In mountainous areas where it is impossible to make full use of normal engineer heavy equipment in road and bridge construction, reliance is placed on hand labor and augmentation of the normal allocation of hand tools.

____ The restrictions on movement characteristic of mountains renders the logistic effort more difficult and may affect the operation plan.

____ Evacuation sections of medical units are augmented with additional litter teams and additional equipment to facilitate evacuation of casualties from nearly inaccessible locations.

____ The infantry battalion is generally organized and equipped for combat in mountains; however, additional and substitute equipment may be required to facilitate continuous movement, communications, and logistic support.

____ Counterguerrilla training at all levels emphasizes physical and mental conditioning, combat tactics, long range patrol operations, cross-country movement at night, and the employment of tactical aircraft.

____ To prevent the infiltration of enemy forces, maximum use of surveillance equipment is required for sustained periods to overcome extremely bad weather conditions and the lack of mutual support between units.

APPENDIX F

CHECKOFF LIST FOR MOUNTAIN DRIVING

I. MOVEMENT ON STEEP GRADES

____ Negotiate all grades by driving (consider winching only as a last resort).

____ Use chains when there is ice or mud on the road surface.

____ Climb short, steep ditches by building up momentum in the approach.

____ Approach steep grades with a slow, steady pull.

II. WINCHING

____ Select a route with frequent anchor points in the form of trees or rocks.

____ Use a ground anchor when trees and rocks are not available.

____ Use one prime mover at each point where winching is necessary to winch other vehicles or howitzers in turn as they arrive at the position.

____ Winch howitzers, up or down, with the trails of the weapons downhill.

____ Place the gear of the vehicle in neutral and allow the winch to pull steadily on steep slopes.

____ Do not engage power on winch too suddenly.

____ Clear all obstruction from the route in front of the wheels.

III. DAYLIGHT DRIVING

____ Drive in open column to reduce vulnerability to air attack.

____ Use extreme care on sharp, blind curves and steep grades.

____ Take all curves at a speed which permits halting the vehicle in half the visible road space.

____ Take grades in a gear ratio that permits the vehicle to take the entire hill without shifting.

____ Exercise caution to see that the speed of the vehicle does not exceed two-thirds of the speed for the particular gear ratio.

____ Descend hills with a combination of braking and engine.

____ Use the same gear in descending as would be used in ascending.

____ Post guides at dangerous places, especially when backing or turning are required, to give directions.

IV. DRIVING AT NIGHT

____ Keep driving without lights on narrow winding mountain roads to a minimum.

____ Limit blackout driving to stretches of road visible to the enemy.

____ Post signs and guides to give special instructions to drivers approaching blacked-out areas.

____ Drive trucks in close column.

____ Have assistant driver precede vehicle on foot when driver cannot see the road or the taillight of the vehicle to his front.

____ Do not permit lead vehicles to exceed 8 miles per hour.

APPENDIX G

FUEL AND WATER CONSUMPTION DATA

1. FUEL CONSUMPTION DATA--VEHICLES

a. 2½-Ton Truck.--Normal range of 242 miles; burns fuel at the rate of 4 gallons per hour.

b. 5-Ton Truck.--Normal range of 292 miles; burns fuel at the rate of 6 gallons per hour.

c. ½-Ton LIWC.--Normal range of 50 miles; burns fuel at the rate of 1 gallon per hour.

d. M48A3 Tank.--Normal range of 242 miles; burns fuel at the rate of 19 gallons per hour cross country; consumption on roads at the rate of 1.2 gallons per mile; consumption cross country at the rate of 2.5 gallons per mile; fuel capacity of 390 gallons.

e. LVTP7.--Normal cruising range of 300 miles on land and 56 miles on water; consumption on land at the approximate rate of 15 gallons per hour and on water at the approximate rate of 25 gallons per hour; fuel capacity of 180 gallons.

2. EQUIPMENT FOR TRANSPORTING FUEL IN THE FMF

a. Class IV Equipment

(1) Sealed bin pods: 525-gallon capacity, 70 cubic feet.

(2) Rolling liquid fuel transporter: 400-gallon and 1,000-gallon capacities.

(3) 2½-ton truck refuelers: 1,200-gallon capacity, 10 per Marine division.

(4) 55-gallon drums.

(5) 5-gallon expeditionary cans.

(6) 2½-ton refuelers: 34 in Marine aircraft wing.

(7) 2,000-gallon refuelers: 38 in Marine aircraft wing.

(8) 5,000-gallon semitrailer refuelers: 27 in Marine aircraft wing.

b. Lub Service Units

(1) 38 in Marine division.

(2) 3 in FSR, FMF.

(3) 1 in 8-inch howitzer battery, FMF.

(4) 1 in 175mm gun battery, FMF.

(5) 5 in tank battalion, FMF.

(6) 1 in communication battalion, FMF.

(7) 1 in headquarters battery, FAG.

(8) 10 in engineer battalion, FMF.

3. EQUIPMENT FOR TRANSPORTING WATER IN THE FMF

a. <u>400-Gallon Water Trailers</u>.--82 authorized in Marine division; 7 authorized in tank battalion, FMF; 4 authorized in 8-inch howitzer battery, FMF; 2 authorized in 175mm gun battery, FMF; 43 authorized in FSR, FMF.

b. <u>1,000-Gallon Water Trucks</u>.--14 in Marine aircraft wing.

c. <u>400-Gallon Water Trailers</u>.--101 in Marine aircraft wing and 5-gallon expeditionary cans in all units.

APPENDIX H

VEHICLE MAINTENANCE CHECKLIST FOR DESERT OPERATIONS

The degree of mobility of the unit in desert operations depends upon how well the extreme difficulties encountered in vehicle maintenance and supply are overcome. To keep vehicles rolling, it is mandatory that the following critical maintenance and supply items be checked on a regularly scheduled basis:

1. OVERHEATING

Overheating is one of the major problems in the desert. It can cause serious damage to the vehicle. Accordingly, drivers should be trained to observe the following precautions while operating vehicles:

___ Check the temperature gauge frequently. If the engine is overheating, halt vehicle into the wind and cool it off by operating the engine at idle speed. Caution must be taken not to halt the vehicle downwind and not to turn the engine off while it is too hot as this can cause the block to crack.

___ Do not remove the side panels from the engine compartment. Removal of these panels reduces turbulence of air around the engine and causes overheating.

___ Keep the fan belt tension properly adjusted. Keep the fan belt in good condition.

___ Keep the radiator cowling and core free from any refuse.

___ Check for cooling system leaks during maintenance inspections.

2. AIR CLEANER

Air cleaner maintenance is a must in desert operations if any degree of prolonged engine life is to be assured. While the oil-bath filter is kept clean, it will protect the engine. Drivers should be trained to service the air cleaners as often as driving conditions warrant. In the desert, this may be necessary three or four times daily. When servicing air cleaners, drivers should check the following items:

___ Check to see that all assembly and mounting gaskets are secure and in good condition.

___ Inspect the filter elements for their general condition and air filtering capabilities.

___ Inspect the oil-bath air cleaner type filters for cleanliness and oil level.

___ Inspect the crankcase breather and the filler cap filters.

3. SERVICING EQUIPMENT

___ Wipe the sand from all filter caps before removing them.

___ Ensure that all dispensers and containers used for servicing are clean before they are used to dispense oils and lubricants.

___ Keep exposed bearing surfaces, such as contant velocity joints, free from sand and dirt. This may necessitate the construction of leather or canvas boots to cover these surfaces when operating in extremely dusty areas.

4. TIRES

The heat, sand, and rough ground surfaces of desert areas shorten tire life.

___ Remove stones from tires as often as possible.

___ Keep stored tires in covered, well-ventilated areas.

___ Maintain tires at the air pressure which provides mobility through the most difficult terrain to be traversed during the day's operations.

5. COOLING SYSTEM

___ Flush and clean frequently.

___ Use a corrosion inhibitor in the water.

___ Whenever possible, use alkali-free water.

___ Inspect condition of water pumps and fan belts frequently.

___ Check level of water in the radiator.

___ Check thermostat for opening and closing at calibrated temperatures.

6. REPAIR PARTS

___ Axle shafts, wheel bearings, and oil and grease seals.

___ Spring shackles, shackle bolts, complete sets of front and rear spring levels, propeller shaft universal joints, and pillor blocks.

___ Water pumps and gaskets, fan belts, water hoses, clamps, and tape.

___ Brake, oil, and fuel lines.

___ Wheel and tire lug nuts, valve caps, plugs for oil drainage fittings, caps for gas tanks, radiators, and storage batteries.

___ Panel instruments and extra speedometers and cables for vehicles operating separately, such as reconnaissance vehicles.

___ Windshields, carburetors, and fuel pumps.

___ Oil filter elements and air cleaners.

LIST OF REFERENCES

1. JOINT PUBLICATIONS

FMFM 11-3/FM 3-10, Employment of Chemical Agents
FMFM 11-4/FM 101-31-1, Employment of Nuclear Weapons
FMFM 11-4A/FM 101-31-2, Employment of Nuclear Weapons (U)
FMFM 11-4B/FM 101-31-3, Employment of Nuclear Weapons

2. LANDING FORCE MANUALS

LFM 01, Doctrine for Amphibious Operations
LFM 02, Doctrine for Landing Forces

3. FLEET MARINE FORCE MANUALS

FMFM 2-1, Intelligence
FMFM 2-2, Amphibious Reconnaissance
FMFM 2-3, Signal Intelligence/Electronic Warfare Operations (U)
FMFM 3-1, Command and Staff Action
FMFM 3-3, Helicopterborne Operations
FMFM 4-1, Logistics and Personnel Support
FMFM 4-2, Embarkation
FMFM 4-3, Shore Party and Helicopter Support Team Operations
FMFM 4-4, Engineer Operations
FMFM 5-1, Marine Aviation
FMFM 6-1, Marine Division
FMFM 6-2, Marine Infantry Regiment
FMFM 6-3, Marine Infantry Battalion
FMFM 6-4, Marine Rifle Company/Platoon
FMFM 6-5, Marine Rifle Squad
FMFM 7-1, Fire Support Coordination
FMFM 7-2, Naval Gunfire Support
FMFM 7-4, Field Artillery Support
FMFM 8-2, Counterinsurgency Operations
FMFM 9-1, Tank Employment/Antimechanized Operations
FMFM 9-2, Amphibious Vehicles
FMFM 10-1, Communications

4. U.S. NAVY PUBLICATIONS

ATP 17, Naval Arctic Operations
NWIP 10-3, Naval Warfare Terms
NWP 11, Naval Operations Planning
NWP 16(_), Basic Operational Communications Doctrine
NWIP 22-1, Amphibious Task Force Planning
NWIP 22-2, Supporting Arms in Amphibious Operations
NWIP 22-3, Ship-to-Shore Movement
NWIP 22-4, Underwater Demolition Teams in Amphibious Operations
NWIP 22-5, The Naval Beach Group
NWP 36, Armed Forces Doctrine for Chemical and Biological Weapons Employment Defense
NWIP 41-6, Helicopter Operations

5. U.S. ARMY FIELD MANUALS

FM 5-15, Field Fortifications
FM 5-20, Camouflage
FM 5-25, Explosives and Demolitions
FM 5-30, Engineer Intelligence
FM 5-34, Engineer Field Data
FM 5-35, Engineers Reference and Logistical Data
FM 5-36, Route Reconnaissance and Classification
FM 6-20-1, Field Artillery Tactics
FM 6-20-2, Field Artillery Techniques
FM 7-30, The Infantry Brigades
FM 17-1, Armor Operations
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FM 20-32, Landmine Warfare
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FM 21-5, Military Training Management
FM 21-10, Field Hygiene and Sanitation
FM 21-11, First Aid for Soldiers
FM 21-15, Care and Use of Individual Clothing and Equipment
FM 21-18, Foot Marches
FM 21-26, Map Reading
FM 21-40, Chemical, Biological, Radiological, and Nuclear Defense
FM 21-50, Ranger Training and Ranger Operations
FM 21-60, Visual Signals
FM 21-75, Combat Training of the Individual Soldier and Patrolling
FM 24-18, Field Radio Techniques
FM 24-20, Field Wire and Field Cable Techniques
FM 30-5, Combat Intelligence
FM 30-10, Military Geographic Intelligence (Terrain)
FM 30-16, Technical Intelligence
FM 30-20, Aerial Surveillance-Reconnaissance, Field Army
FM 31-10, Denial Operations and Barriers
FM 31-12, Army Forces in Amphibious Operations (The Army Landing Force)
FM 31-21, Special Forces Operations-U.S. Army Doctrine
FM 31-35, Jungle Operations
FM 31-40, Tactical Cover and Deception (U)
FM 31-50, Combat in Fortified and Built-Up Areas
FM 31-60, River Crossing Operations
FM 31-70, Basic Cold Weather Manual
FM 31-71, Northern Operations
FM 31-72, Mountain Operations
FM 54-2, Division Support Command and Separate Brigade Support Battalion
FM 55-15, Transportation Reference Data
FM 55-30, Army Motor Transport Operations
FM 61-100, The Division
FM 100-5, Operations of Army Forces in the Field
FM 100-10, Combat Service Support
FM 100-15, Larger Units Theater Army-Corps
FM 101-5, Staff Officers Field Manual, Staff Organization and Procedures
FM 101-10-1, Staff Officers Field Manual, Organizational, Technical, and Logistical Data

6. TECHNICAL PUBLICATIONS

TM 5-177, Bailey Bridge
TM 5-220, Passage of Obstacles Other Than Minefields
TM 5-279, Suspension Bridges for Mountain Warfare
TM 9-207, Operation and Maintenance of Ordnance Material in Cold Weather
TM 9-1300-203, Ammunition for Antiaircraft, Tank, Antitank, and Field Artillery Weapons
TM 10-275, Principles and Utilization of Cold Weather Clothing and Sleeping Equipment
TM 11-666, Antennas and Radio Propagation

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